1974

Cadillac

SHOP MANUAL

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended by Cadillac and described in this service manual are effective methods of performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that this manual contains various Warnings, Cautions and Notes which should be carefully read in order to minimize the risk of personal injury to service personnel or the possibility that improper service methods will be followed which may damage the vehicle or render it unsafe. It is also important to understand that these Warnings, Cautions and Notes are not exhaustive. Cadillac could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Cadillac has not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Cadillac must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects.

THE CADILLAC CRAFTSMAN'S LEAGUE

CADILLAC
CRAFTSMAN

CADILLAC CRAFTSMAN CODE

I HEREBY pledge myself in all my work on Cadillac cars, to be thorough and exact in diagnosing trouble; to recommend only that service which is to the best interest of the owner; to perform that work for which I am responsible in accordance with Cadillac standards to the best of my ability, and in all my dealings with Cadillac owners, to be courteous, honest, and ethical; and to do everything within my power to further the owner's satisfaction and promote his good will to Cadillac and to my dealer.

The Cadillac Craftsman's League is a program sponsored by Cadillac Motor Car Division for the benefit of authorized dealer's service departments. Participation in the League is open to Cadillac servicemen and partsmen, including department managers and apprentices. Enrollment information is available from the Zone Service Representative.

1974 CADILLAC SHOP MANUAL

Service information pertaining to features exclusive to the Eldorado is provided at the back of the individual sections in this manual. All other service information for the Eldorado is the same as that described in the forward portion of the individual sections.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

Service Department
CADILLAC MOTOR CAR DIVISION
General Motors Corporation
Detroit, Michigan 48232

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GENERAL INFORMATION, MAINTENANCE AND LUBRICATION

Foreword

This Shop Manual has been prepared by the Service Department of the Cadillac Motor Car Division to aid in servicing 1974 model Cadillac automobiles. It is intended primarily for servicemen who are familiar with earlier model Cadillacs. It includes complete information on service procedures and specifications pertaining to all 1974 Cadillac cars except body and Air Cushion Restraint System (ACRS) diagnosis and service information which are covered in separate manuals. Refer to the body service manual for servicing Cadillac body items and the Air Cushion Restraint System Service Manual for diagnosis and servicing the ACRS system. Removal and installation procedures of parts which are not part of the ACRS system, but which require different procedures due to the ACRS option are included in their respective sections of this manual.

Arrangement of the Manual

The title page contains a rapid reference section index with headings corresponding to the page tabs at the beginning of each section. A Table of Contents is provided at the beginning of each section that contains more than one major subject. A complete alphabetical index is located at the back of the manual.

The individual sections include theory of operation and diagnosis at the beginning of each section followed by service adjustments and replacement procedures. An illustrated list of special tools, a torque requirement chart, and specifications are provided as required at the end of each section.

Service information pertaining only to those features that are exclusive to the Eldorado is provided at the back of the individual sections in the manual. For Eldorado service procedures and recommendations not listed, refer to the forward part of the appropriate section, as these service procedures are similar to those on other 1974 Cadillac cars.

GENERAL INFORMATION

Vehicle Identification Number

Each 1974 Cadillac automobile or commercial chassis carries a 13 digit vehicle identification number used for license and insurance identification and in general reference to the automobile. The number is located on the forward lower edge of the windshield trim molding on the driver's side of the car where it is visible through the windshield. The 1974 Cadillac identification number is decoded as follows: (Fig. 0-1)

The last six digits of the number determine the

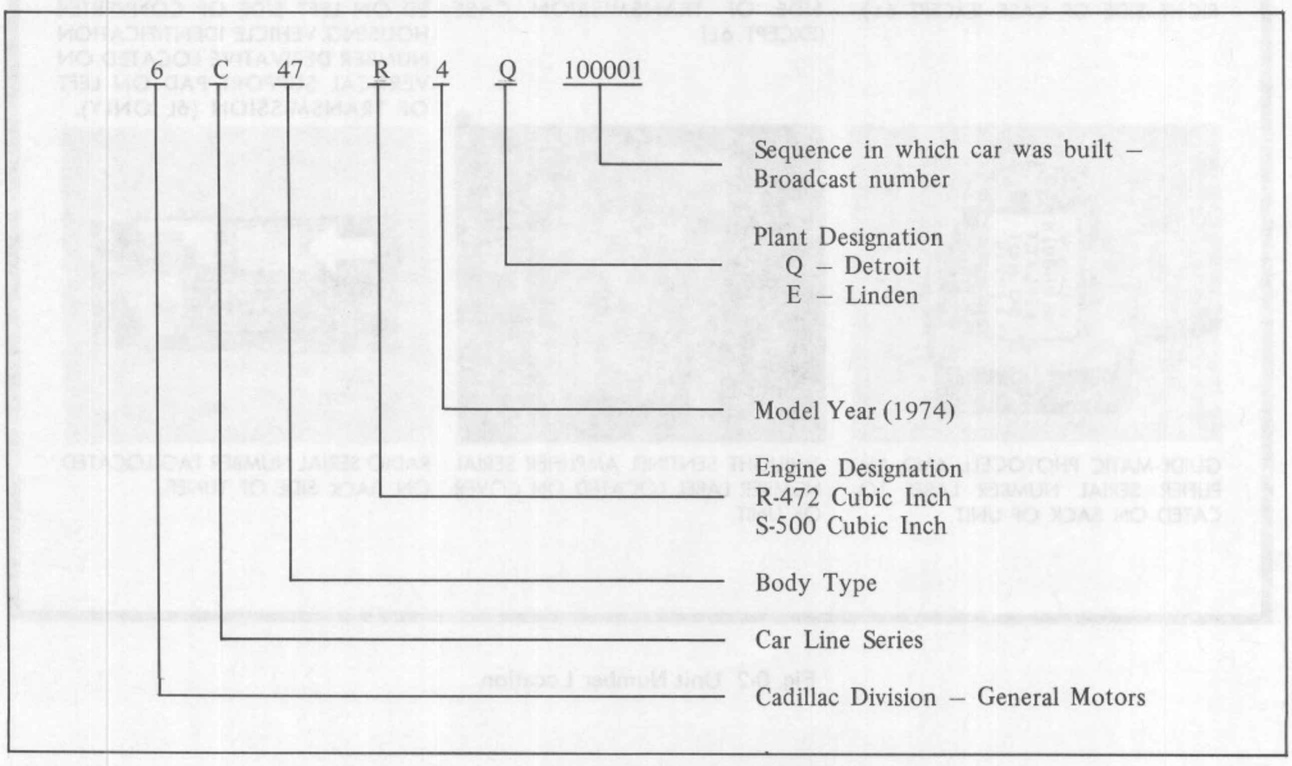
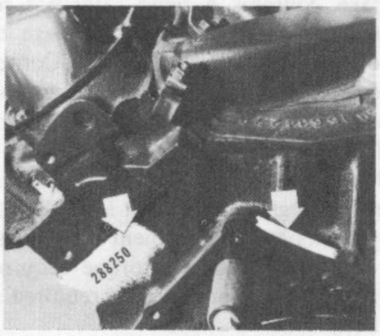
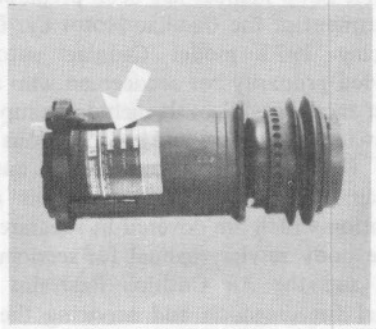


Fig. 0-1 Vehicle Identification Number

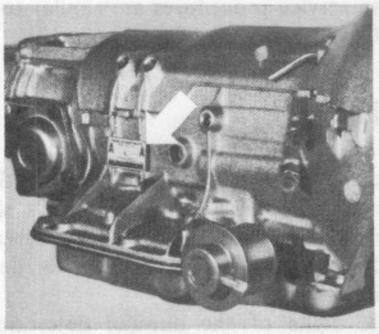


ENGINE UNIT NUMBER ON BLOCK BEHIND LEFT CYLINDER HEAD; V.I.N. DERIVATIVE ON BLOCK BEHIND INTAKE MANIFOLD

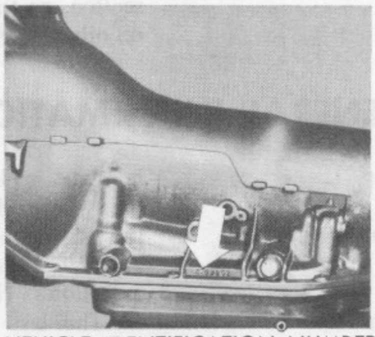
VEHICLE IDENTIFICATION NUMBER LOCATED ON PLATE RIVETED TO COWL BAR IN THE LOWER LEFT HAND CORNER OF THE WINDSHIELD.



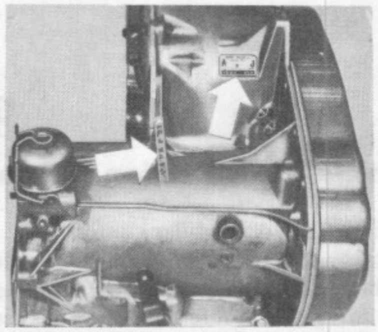
A/C COMPRESSOR SERIAL NUMBER LABEL LOCATED ON REAR PORTION OF COMPRESSOR HOUSING.



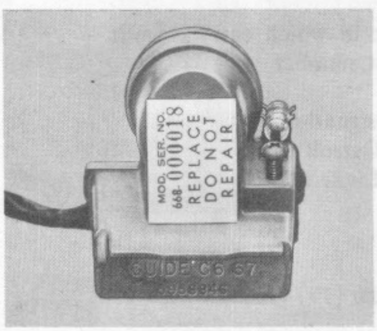
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON RIGHT SIDE OF CASE (EXCEPT 6L)



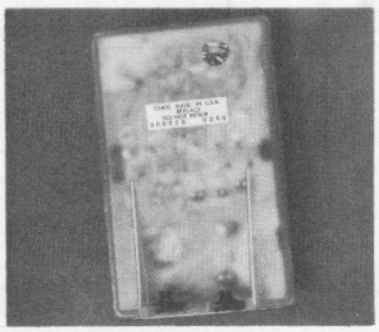
VEHICLE IDENTIFICATION NUMBER DERIVATIVE LOCATED ON LEFT SIDE OF TRANSMISSION CASE (EXCEPT 6L)



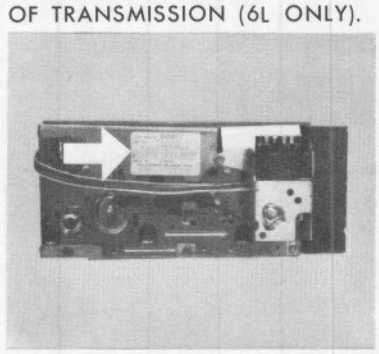
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON LEFT SIDE OF CONVERTER HOUSING. VEHICLE IDENTIFICATION NUMBER DERIVATIVE LOCATED ON VERTICAL SUPPORT PAD ON LEFT OF TRANSMISSION (6L ONLY).



GUIDE-MATIC PHOTOCELL AND AMPLIFIER SERIAL NUMBER LABEL LOCATED ON BACK OF UNIT.



TWILIGHT SENTINEL AMPLIFIER SERIAL NUMBER LABEL LOCATED ON COVER OF UNIT.



RADIO SERIAL NUMBER TAG LOCATED ON BACK SIDE OF TUNER.

Fig. 0-2 Unit Number Location

sequence in which the car was built. Assembly lines are assigned specific sequence numbers as follows:

100001 through 350000 Detroit built "C" series and Eldorados built on the "C" series assembly line.

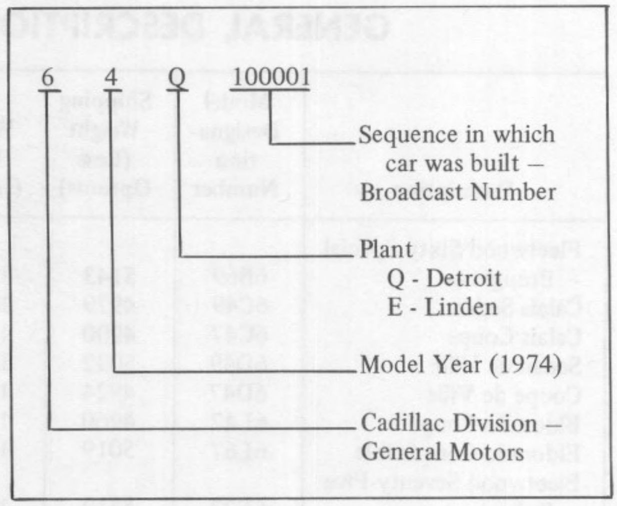
400001 through 499999 Detroit built Eldorados (except those built on the "C" series assembly line.)

500001 through 600000 Linden built DeVille series.

CAR LINE or SERIES NAME	VIN CAR LINE/ BODY TYPE DESIGNATOR	BODY TYPE
Brougham	B69	4-Door Sedan
Calais	C49	4-Door Hardtop Sedan
Calais	C47	2-Door Coupe
DeVille	D49	4-Door Hardtop Sedan
DeVille	D47	2-Door Coupe
Fleetwood 75	F23	4-Door Sedan
Fleetwood 75	F33	4-Door Limousine
Commercial Chassis	Z90	
Eldorado	L47	2-Door Coupe
Eldorado	L67	2-Door Convertible

The series and model section (2nd, 3rd, and 4th digits) of the vehicle identification number may be further decoded using the above chart. These two numbers are interchangeable when referring to the automobile.

A nine-digit derivative of the vehicle identification number is applied to the engine and transmission at the locations shown in Fig. 0-2. This derivative is used for in-plant control of these assemblies and may be used by law enforcement or other officials to identify proper engine-chassis combinations. This number should contain the same numbers and letters as the vehicle identification number but in the condensed form shown above.



Identification Numbers

Locations of identification numbers on various units are shown in Fig. 0-2. The identification number on the unit should always appear on product report forms sent to the Central Office such as PIR's, Claim Tags, Pre-Delivery Reports and, when required, on Warranty Claims. The 13 digit Vehicle Identification Number is necessary when reporting product information on any vehicle.

Body Identification Plate

A body identification plate, Fig. 0-3, is attached to the top surface of the shroud on the right side, under the hood, near the cowl. The name plate carries the style number, trim number, body number, and paint number in the areas indicated by ST, TR, BDY, and PNT.

The first two digits of the style number (ST) indicate the model year while the remaining five digits indicate the model designation.

The numbers following the trim number (TR) indicate the interior trim color and seat type.

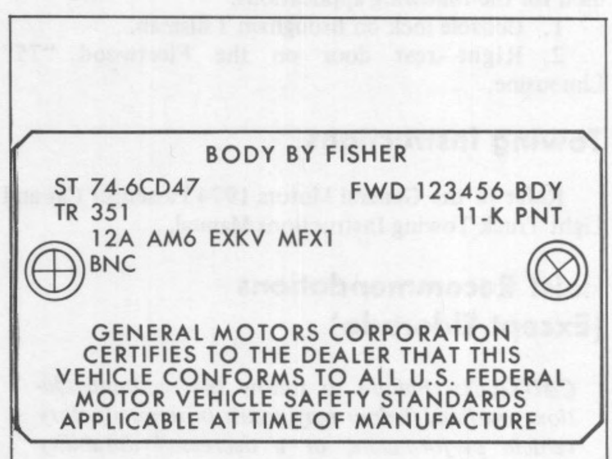


Fig. 0-3 Body Identification Plate

GENERAL DESCRIPTION AND SPECIFICATIONS

Description	Model Designation Number	Shipping Weight (Less Options)	Wheelbase (Inches)	Overall Length (Inches)	Overall Height (Inches)	Maximum Width (Inches)	Tread Width Front	Tread Width Rear
Fleetwood Sixty Special Brougham	6B69	5143	133.0	233.7	55.6	79.8	63.3	63.3
Calais Sedan	6C49	4979	130.0	230.7	54.4	79.8	63.3	63.3
Calais Coupe	6C47	4900	130.0	230.7	53.9	79.8	63.3	63.3
Sedan de Ville	6D49	5032	130.0	230.7	54.4	79.8	63.3	63.3
Coupe de Ville	6D47	4924	130.0	230.7	53.9	79.8	63.3	63.3
Eldorado Coupe	6L47	4960	126.3	224.1	54.1	79.8	63.7	63.6
Eldorado Convertible	6L67	5019	126.3	224.1	54.5	79.8	63.7	63.6
Fleetwood Seventy-Five Sedan	6F23	5719	151.5	252.2	57.4	79.8	63.3	63.3
Fleetwood Seventy-Five Limousine	6F33	5883	151.5	252.2	57.2	79.8	63.3	63.3
Commercial Chassis	6Z90		157.5	—	—	—	63.3	65.0

The body number (BDY) consists of three letters indicating the assembly plant and six digits indicating the sequence in which the body was built.

The first two digits of the paint number (PNT) indicate color of the body shell and chassis sheet metal; the letter indicates color of convertible and vinyl tops.

The number-letter code at the left below trim indicates date of assembly (month-01 through 12, week A through E).

Number-letter codes following the date of assembly indicate Fisher Body options and accessories installed at the factory.

Keys

All 1974 Cadillacs use TWO specific keys.

1. Square head – used for ignition switch ONLY.
2. Oval head – used for doors, glove box and trunk.

In addition, a third specific notched oval head key is used for the following applications.

1. Console lock on Brougham Talisman.
2. Right rear door on the Fleetwood "75" Limousine.

Towing Instructions

Refer to the General Motors 1974 Passenger Car and Light Truck Towing Instructions Manual.

Hoist Recommendations (Except Eldorado)

CAUTION: Failure to follow the recommendations outlined below may result in unsatisfactory vehicle performance, or a decreased durability which may result in loss of control of the vehicle.

The preferred type of hoist for lifting Cadillacs is one that engages the front suspension and rear axle, or all four wheels.

The front lower suspension arm is designed with a flattened portion on the flange of the arm for use with lifting equipment that engages the suspension system. When using lifting equipment of this type, make certain that the car is properly centered over the hoist and that the hoist arms are positioned under the flattened portion of the flange, Fig. 0-4, outboard of the safety locaters. If the hoist arms are not properly positioned in relation to the lower support arms, damage to the steering linkage or brake lines could result, or the car may shift on the hoist.

CAUTION: The rear lower control arms should never be used as a lift point.

If a frame-engaging hoist is used, certain precautions must be observed. The shaded areas of the frame, Fig. 0-5, indicate the only acceptable positions for lift pads. Pads must be used in these areas with maximum surface contact and must contact only those parts of the frame indicated.

(NOTE: Certain cars are equipped at these locations with special brackets used for rail shipment. If such

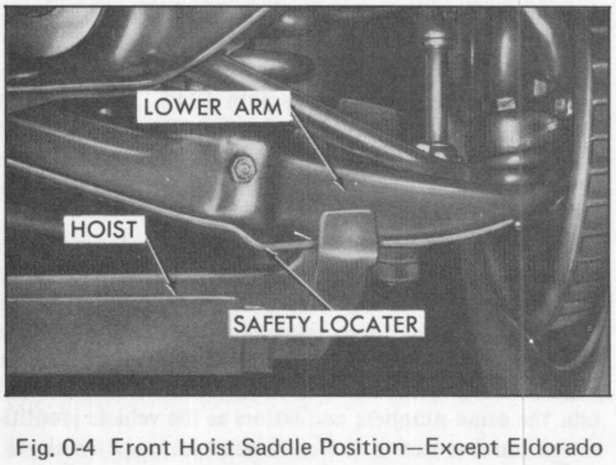


Fig. 0-4 Front Hoist Saddle Position–Except Eldorado

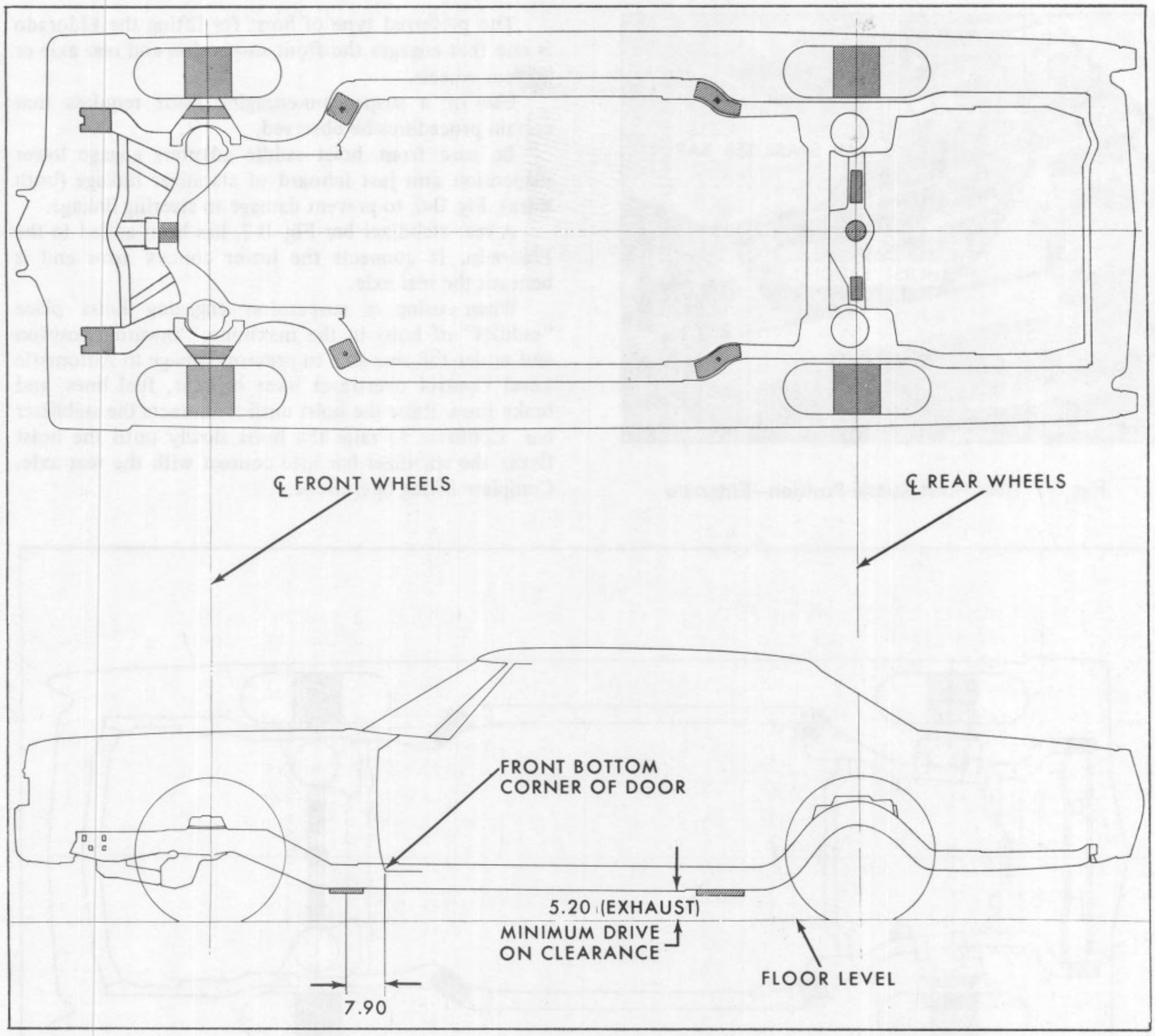


Fig. 0-5 Lifting Locations—Except Eldorado and Commercial Chassis

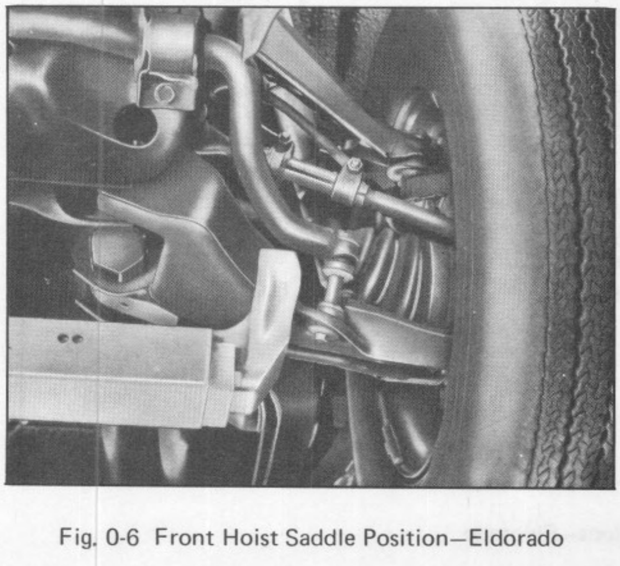


Fig. 0-6 Front Hoist Saddle Position—Eldorado

a situation is encountered, be sure to engage bracket fully rather than at the edges.)

Do not use a frame-engaging hoist to raise the Fleetwood Seventy-Five Sedan and Limousine or the Commercial Chassis.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should the rear end of car be raised so that rear suspension is in rebound position while disconnecting shock absorbers.

Hoist Recommendations (Eldorado Only)

CAUTION: Failure to follow the recommendations outlined below may result in unsatisfactory vehicle performance, or decreased durability which may result in loss of control of the vehicle.

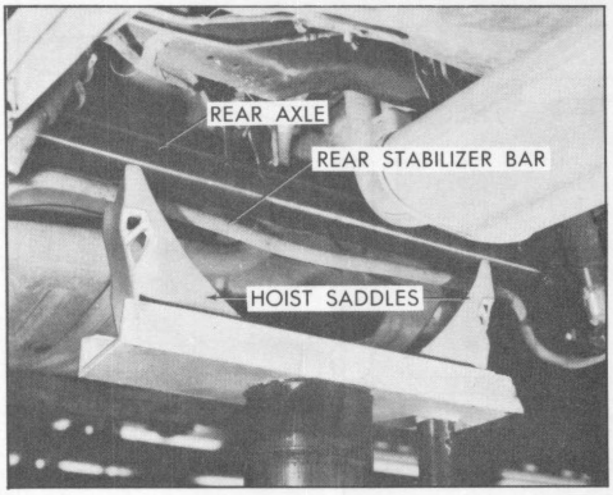


Fig. 0-7 Rear Hoist Saddle Position—Eldorado

The preferred type of hoist for lifting the Eldorado is one that engages the front suspension and rear axle or all four wheels.

Use of a suspension-engaging hoist requires that certain procedures be observed.

Be sure front hoist saddle adapters engage lower suspension arm just inboard of stabilizer linkage (both sides), Fig. 0-6, to prevent damage to steering linkage.

A rear stabilizer bar Fig. 0-7, has been added to the Eldorado. It connects the lower control arms and is beneath the rear axle.

When using a suspension engaging hoist place "saddles" of hoist in the maximum "inward" position and under the rear axle to prevent damage to Automatic Level Control overtravel lever bracket, fuel lines, and brake lines. Raise the hoist until it contacts the stabilizer bar. Continue to raise the hoist slowly until the hoist flexes the stabilizer bar into contact with the rear axle. Complete lifting operations.

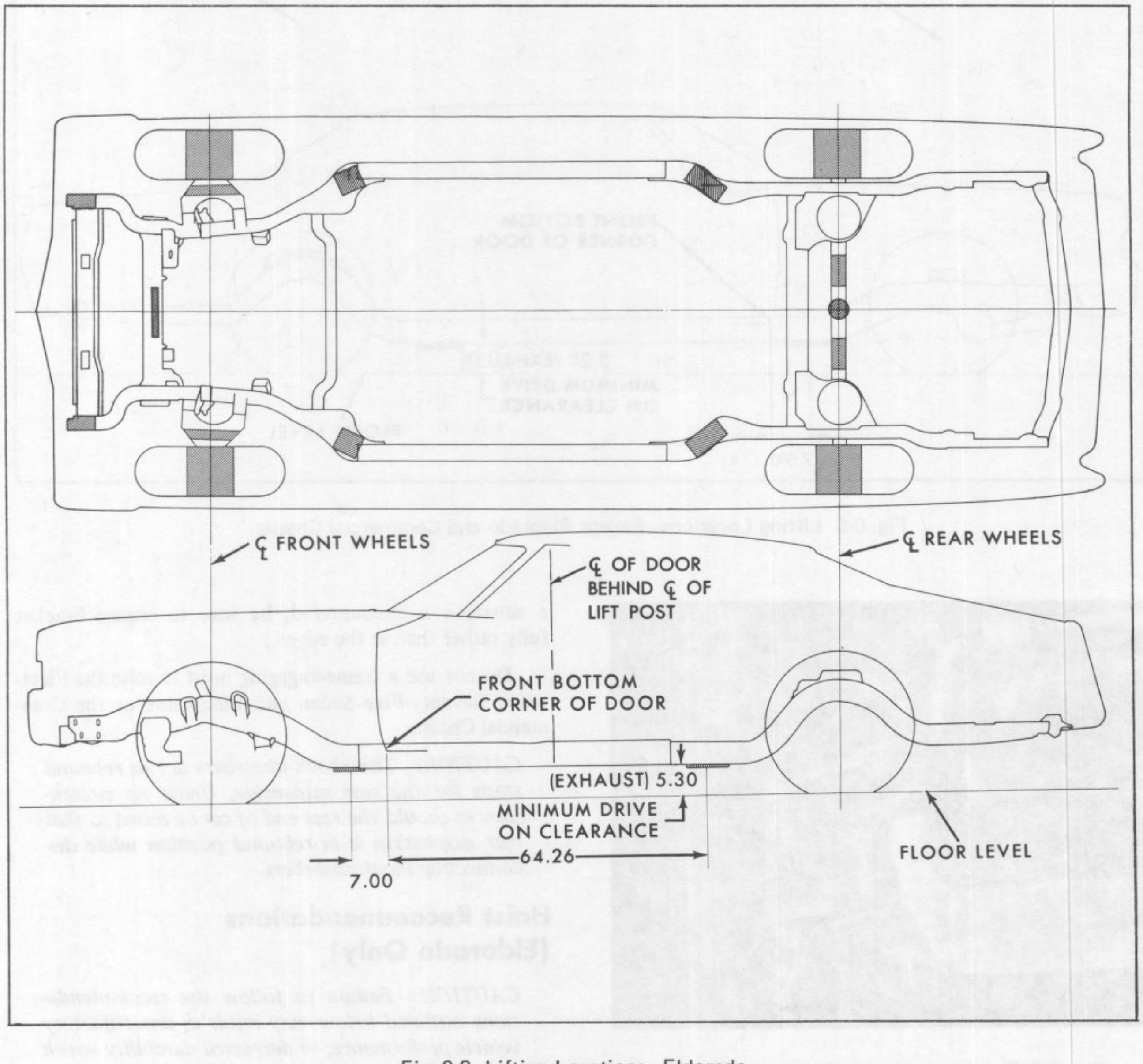


Fig. 0-8 Lifting Locations—Eldorado

CAUTION: The rear lower control arm should never be used as a lift point. Doing so could result in damage to the rear suspension and non standard vehicle performance.

If a frame engaging hoist is used, certain precautions must also be observed.

Make sure that hoist adapters and "tabs" are in lowered position before driving on or off the lift.

Position hoist adapter "tabs" in raised position to obtain maximum possible height between frame and hoist.

Be sure to position adapter tabs in exact locations shown in the shaded areas of Fig. 0-8 and make sure the centerline of the door is behind the centerline of the lift post for proper weight distribution.

(NOTE: Certain cars are equipped at these locations with special brackets used for rail shipment. If such a situation is encountered, be sure to engage bracket fully rather than at the edges.)

An additional precaution of using two floor stands under the front frame cross member of the Eldorado is recommended when heavy mechanical operations are to be performed. Be sure to remove these stands before attempting to lower the vehicle.

If a drive-on hoist is used, be sure the center line relationship as stated above is also applied, Fig. 0-8.

When supporting the Eldorado with a floor jack or jack stands, the supports should be placed at the suspension lift points or the frame contact lift points. The Eldorado should never be supported at the extreme ends of the frame or at the center of the frame side rail or lifted at the front or rear bumper with anything other than the bumper jack provided with the car.

VIBRATION COMPLAINTS AND CORRECTION

(NOTE: Before proceeding with the vibration correction procedure make certain any and all performance problems are completely resolved.)

There are several excitation sources and many responding systems which may cause an annoying vibration. The first step is to identify individual vibration complaints by systematically classifying them, during a road test, into one or more of the following categories: (1) car speed sensitive, (2) engine speed sensitive, (3) torque (throttle) sensitive, or (4) jounce sensitive. Since each of these categories has specific vibrations associated with it, this classification will give direction to the proper area for analysis of the problem. This will eliminate many components that cannot be the cause, and will focus attention on only those items that can contribute to the specific condition encountered.

1. Road Test

Prior to the initial road test, check and adjust the tire pressures and install an engine tachometer. Next, ride the car with the owner driving and have him point out the disturbance with which he is concerned.

(NOTE: The importance of riding in the car with the owner cannot be over-emphasized.)

If the condition is normal, and no corrective work is needed, the owner should be told immediately. This normalcy can be demonstrated with other vehicles, pointing out that similar vehicles have the same condition.

2. Sensitivity Classification

Having verified that a vibration problem does exist, the first step in correcting the problem is to classify it in terms of one or more of the following sensitivity categories.

a. Car Speed Sensitive

Most vibration complaints will be found to be car speed sensitive, i.e., the frequency of the excitation depends only on the speed of the vehicle. To determine if a given problem is car speed sensitive:

(1) Drive the car in "Drive Left" and record the car speed and the engine RPM at which the problem occurs.

(2) Shift the car into "Drive Right" and again record the car speed and the engine RPM at which the problem occurs.

(3) If the problem occurs at the same car speed as when the car was in "Drive Left", the vibration is car speed sensitive.

(NOTE: It is possible that two problems could occur at the same car speed. Decelerate the engine to the RPM obtained in Step 1 and check to see that problem has disappeared. If it has not, there are two problems: one of which occurs at the car speed determined in Step 1, while the second occurs at the engine speed determined in Step 1.)

b. Engine Speed Sensitive

Another group of vibration complaints will be found to be engine speed sensitive, i.e., the frequency of the excitation depends only on the speed of the engine, independent of the speed of the vehicle. To determine if a given problem is engine speed sensitive.

(1) Drive the car in "Drive Left" and locate the vibration problem. Record the car speed and the engine RPM at which the problem occurs.

(2) Shift the car into "Drive Right" and again locate the vibration problem. Record the car speed and the engine RPM at which the problem occurs.

(3) If the problem occurs at the same engine speed as when the car was in "Drive Left", the vibration is engine speed sensitive.

c. Torque Sensitive

A torque sensitive problem is one which increases in intensity as the torque (power) output of the engine increases, i.e., the intensity of the vibration increases as the throttle opening is increased. To determine if a given problem is torque sensitive:

(1) Drive the car in "Drive Left" and record the car speed and engine RPM at which the problem occurs.

(2) Observe the condition while varying the throttle position. Drive the car with steady throttle, slowly increasing to heavy throttle by going up hill or applying the brakes while increasing the throttle opening, and slowly decreasing to minimum throttle by coasting through the vibration speed.

(3) If the condition becomes more severe as the throttle opening is increased, the vibration is torque sensitive.

d. Jounce (or Load) Sensitive

A jounce (or load) sensitive problem is one which varies in intensity as the height of the car changes with respect to the surface of the road, i.e., the intensity varies as the rear springs are extended or compressed. To determine if a given problem is jounce (or load) sensitive:

(1) Drive the car and observe the condition with varying passenger load.

(2) Alternately, drive the car over a road that dips in such a way that is causes the rear of the car to move up and down relative to the surface of the road. Keeping a constant throttle, observe the condition.

(3) If the condition varies depending on the passenger load (or varies as the rear of the car moves up and down), the problem is jounce (or load) sensitive.

e. Multiple Classification

In the process of classifying vibration problems in terms of these four sensitivity categories, you will find that many problems fit more than one of the categories. Combining these categories into their possible combinations, the majority of all vibration problems will fall into one of the following "cases" of categories:

(1) Engine speed sensitive only
(2) Car speed sensitive only
(3) Torque sensitive and car speed sensitive
(4) Torque sensitive and engine speed sensitive

3. Engine Speed Sensitive Only

Problems in this class may be duplicated with the car stopped and the transmission in neutral by running the engine at the RPM at which the disturbance was felt during the road test. All additional appraisals can thus be made under this "free engine" condition.

"Free engine" problems can be due to belts or engine driven accessories (power steering pump, generator, air conditioning compressor, fan, etc.). To isolate the offending component, first check the torque on all accessory mounting bracket bolts. Also, check the condition and tension of all accessory drive belts. If any abnormal conditions are found, correct and retest for the vibration problem.

Air conditioning compressor problems can be diagnosed by turning compressor off and on while the vibration problem is being experienced.

If tightening the accessory mounting bolts and adjusting the drive belt tensions fails to correct the disturbance, remove accessory drive belts, one at a time, tighten the accessory mounting bolts, and retest for the problem. Continue to remove the belts one at a time until the offending component is located.

CAUTION: With the water pump drive belt removed, the engine may overheat rapidly resulting in possible engine damage; hence, this appraisal must be made very quickly.

4. Car Speed Sensitive Only

All tire problems are sensitive to car speed only. Driveline unbalance or runout is sensitive to car speed at the rate of one vibration per revolution (First Order). Driveline vibrations at the rate of two or more vibrations per revolution, on either "C" cars or Eldorado, are sensitive to both car speed and torque, and should not be considered as "car speed sensitive only".

a. Suspension Hop and Tramp (Tire Balance)

In order to verify suspension hop & tramp as excited by tire balance and/or runout, proceed as described in Section 10.

b. Balancing Wheels, Tires, and Brake Drums

Many wheel balancers will adequately balance the wheel-tire-brake drum assembly; however, it is the skill of the operator that really is important. The operator must be well trained on the equipment used.

c. Checking Tire, Wheel Brake Rotor and Rear Axle Runout

Excessive runout will cause a vibration which is exactly like unbalanced wheels and tires. After balancing tires, if a 1st order tire disturbance still exists, check runout as follows:

1. Wheel and Tire Runout

Follow procedure described in Section 10. If the runout cannot be reduced to acceptable values by repositioning the tire and wheel, replace the parts at fault. Retest on the road.

2. Brake Rotor and Axle Shaft Runout

a. If after checking wheel runout (radial and lateral), it is determined that excessive runout is present, check brake rotor or axle shaft for runout with a dial indicator before replacing wheel. Refer to Section 5 for specifications on rotor runout.

b. If lateral (in-out) wheel runout (wobble) is beyond specifications, check hub and rotor to wheel pads (front end) or axle flange (rear end) for lateral runout. The dial indicator stem should contact the axle flange or hub and rotor pads as close as possible to the outboard side of the studs.

d. Tire Radial Force Variation

If the disturbance is still present, the problem is due to a non-uniformity in one or more of the tires. This fault is inherent in the tire and often cannot be corrected by any means other than replacement. The problem which remains at this point, however, is to isolate the offending tire(s). This may be accomplished by using a machine capable of measuring loaded radial runout. See Section 10.

5. Torque Sensitive and Car Speed Sensitive

The only excitation which is both car speed sensitive and torque sensitive is 2nd Order driveline (two vibrations per revolution) on the "C" car or 3rd Order Driveline (three vibrations per revolution) on the Eldorado. These problems are caused by improper drive shaft angles which are a result of wrong standing height or faulty joints. Refer to Section 3, to check standing height. Drive axle joint replacement is described in Section 3. Constant velocity universal joint repair is described in Section 4.

6. Torque Sensitive and Engine Speed Sensitive

The only excitation which is both engine speed sensitive and torque sensitive is the "firing order" excitation (that is, 4th Order for an eight cylinder engine). The

problems likely to be encountered in this class are as follows:

a. An engine-driven accessory (power steering pump, generator, air conditioning compressor, etc.) excited by 4th Order Engine.

Engine driven accessories generally do not present a problem if all attachment bolts are torqued to specifications and all drive belts are adjusted to the proper tension. In order to verify that an engine-driven accessory is not the cause of a vibration complaint:

(1) Check installation torques on all attachment bolts securing either an accessory to its mounting or the mounting to the engine.

(2) Check all drive belts for correct tension. Also check the physical condition of the belts.

(3) Visually inspect each accessory to ensure that the brackets installed are complete and properly assembled.

The checks outlined above should be performed and any irregularities corrected before proceeding.

b. Power plant "bending" as excited by 4th Order Engine.

Loosen the top four bolts which attach the transmission to the engine, and reappraise the problem. If this is the actual cause of the complaint, the problem should now occur at a much lower engine speed than it did originally, or be completely eliminated. Retorque bolts before proceeding.

Having thus verified that this is the actual cause of the complaint, the following procedures are suggested as a means of correction:

(1) Inspect the vehicle to be sure the entire engine-transmission assembly and the exhaust system are not in contact with the frame or body.

(2) Inspect the engine and transmission mounts to be sure they have not sagged, or deteriorated.

(3) Check the initial spark advance setting.

(4) If these inspection procedures reveal any irregularities, correct and retest on the road.

c. Exhaust system "bending" as excited by 4th Order Engine. (This may include either the crossover pipe, exhaust pipe, or tailpipe.)

CAUTION: It is often convenient to test for exhaust system vibrations by stalling the engine in Drive with the brakes applied. However, a car should never be stalled at engine speeds greater than 1200-1300 RPM and never for extended periods of time, since the transmission may overheat. When this method of testing is used, it is best done on a hoist, permitting the driveline and rear axle to rotate after each appraisal to circulate transmission oil. Do not use this test method for any problem occuring above 1300 RPM.

When a particular component of the exhaust system, such as the exhaust pipe or tailpipe, is suspected of causing a vibration problem, it may be verified by the following procedure:

(1) Put the car on a hoist with a helper behind the wheel and all doors and windows closed. Next, stall the vehicle in "Drive" as described above in the problem RPM range, while pressing a metal object (such as a wrench or screwdriver) lightly against the suspected component. If this component is the cause, it will "buzz" or "rattle" against the wrench or screwdriver due to its vibratory motion.

(2) To further verify that the suspected component is the cause, pull down rather heavily on that component while the driver evaluates the problem RPM range for any reduction in the level of the disturbance. This method of verification may also be applied on a road test by clamping a 5-10 lb. metal weight securely to the suspected component. Such a weight will change the resonant frequency of the component in question, and will change the problem speed if it is actually the cause.

(3) To verify disturbances produced by exhaust system components which resonate beyond 1300 RPM (such as the exhaust crossover), the stall technique cannot be used. In these cases, it is best to use the weight-and-clamp method together with a road test.

Having verified that some component of the exhaust system is the cause of the problem, the following procedures should be used to correct the disturbance.

(a) Since the majority of exhaust system problems are due to "bound up" conditions, loosen all joints in the entire system, and let the pipes rest on floor stands while each clamp and bolt is torqued to specification. Refer to Section 8.

(b) Visually inspect the entire system for sufficient clearance of all points, (at least 1/2" in all directions) especially those in the direction of engine roll under acceleration.

c. Visually inspect all exhaust system hangers to ensure that there is no metal-to-metal contact.

d. Ensure that the end of the tailpipe is not directed at the inside surface of the rear bumper, but below it.

e. After these procedures have been performed and any irregularities corrected, retest on the road.

CAR STORAGE PREPARATION

Certain precautions must be taken when placing a car in storage for extended periods of time. Listed below are the recommendations to be followed when storing a car for 30 days or less, and for a period of 30 days to 12 months.

a. Car Storage Preparation—30 Days or Less

1. Wash car and inflate tires to 40 pounds pressure.
2. Provide proper cooling system protection. (At least - 40°F).
3. Run engine until completely warmed up; then drain and refill with fresh oil which, according to the label on the can is intended for service "SE".
4. Run engine again with fresh oil until completely warmed up; drive car to place of storage and park. Do not restart again until end of storage period.
5. Be sure parking brake is in released position and car is on level surface.
6. If car is to be stored in a hot area, the fuel tank, lines, pump, filter, and carburetor should be drained.
7. Disconnect battery and prevent battery from discharging or freezing by keeping it fully charged.

b. Car Storage Preparation—30 Days to 12 Months

1. Wash car.

2. Run engine until completely warmed up; then drain and refill with fresh oil which according to the label on the can is intended for service "SE".

3. Run engine again with fresh oil until completely warmed up; drive car to storage area. Run engine at 2,000 rpm in neutral and pour engine oil into carburetor. After about a pint has been added, pour oil fast enough to stall engine.

4. Be sure parking brake is in released position and car is on level surface.

5. Siphon gasoline from fuel tank.

6. Disconnect all fuel lines, blow out, and reconnect.

7. Remove carburetor, clean thoroughly, and store in plastic bag.

8. Remove fuel pump, clean, and store with carburetor. Remove filter assembly and discard.

(NOTE: Tape fuel pump, carburetor, and gas line openings closed with masking tape.)

9. Drain coolant from radiator, cylinder block, and heater cores.

10. Lower windows 1/2 inch to stop humidity "sweat" and mold.

11. Remove battery from car, and have charge maintained during period car is stored.

12. Put car on chassis stands so that tires are off the floor. Position stands under front lower control arms and rear axle as shown in Figures 0-4 through 0-8.

13. Apply 10W engine oil to exterior bright surfaces.

14. When car is taken out of storage, install a new fuel filter, check brake system for leaks, and bleed brakes. Clean spark plugs and regap. Install carburetor, fuel pump, and battery, and refill cooling system.

Special consideration should be given when conditions of high humidity, high temperature, or outdoor storage are encountered. Local experience will dictate the additional protection measures in each particular case.

1974 CADILLAC MAINTENANCE SCHEDULE

To retain the safety, dependability and emission control performance originally built into Cadillacs, it is essential that they receive periodic inspections, maintenance and service parts replacements.

This section contains a complete schedule of the maintenance required by the vehicles, except that additional maintenance requirements for optional Air Cushion Restraint Systems are listed in the ACRS manual.

These inspection and maintenance services are those which experience and testing have shown to be the most likely needed services at that particular mileage or time interval for an average owner. However, the Cadillac serviceman should also recommend additional items of maintenance based on driving habits, driving conditions, geographical locations, climatic conditions, and factory service bulletins.

Explanation of Complete Vehicle Maintenance Schedule

Presented below is a brief explanation of each of the services listed in the preceding Complete Vehicle Maintenance Schedule.

Vehicle operation under conditions such as heavy dust, continuous short trips, use of other than unleaded or low lead fuels or pulling trailers, is not considered normal use and therefore more frequent maintenance will be required. Such additional maintenance requirements are included where applicable. A listing of recommended lubricants and fluids is included in this schedule.

(NOTE: The marked blocks indicate when services should be performed based on mileage intervals as shown in the "When To Perform Services" column.)

Symbols within the following explanations have the meanings listed below.

▲Also a Safety Service
*Also an Emission Control Service

Lube and General Maintenance

$\boxed{1.}$ CHASSIS—Lubricate idler arm, transmission shift linkage, hood latch, hood hinges, parking brake cable guides and linkage and fuel filler door hinges.

Lubricate all transmission linkage friction points each spring and fall with a grade 3 zinc oxide grease (except Eldorado). Lubricate Eldorado linkage with a grade 2 lithium soap grease.

Wipe off any accumulation of dirt or contamination from hood latch parts and apply lubricant to latch striker and latch locking plate. Apply light engine oil to pivot points in release mechanism, as well as primary and secondary latch mechanism.

Lubricate hood hinges. Make hood hinge and latch mechanism functional check to assure the assembly is working correctly.

Apply a light coat of zinc oxide grease to all moving joints of the fuel filler door hinges each spring and fall.

Spherical joints are used on the front suspension system at the outer ends of the upper and lower control arms, and at the inner and outer steering linkage tie rod pivots.

These joints should not need repacking throughout their entire service life under normal driving conditions. At the time of an engine oil change, visually inspect all joint seals for any indication of damage, such as cuts, tears, ruptures, worn spots, etc. If a damaged seal is evident, the seal must be replaced and the joint repacked. Special front suspension lubricant is recommended for the repacking operation.

COMPLETE VEHICLE MAINTENANCE SCHEDULE

Color Code: ☐ Lubrication and General Maintenance ▩ Safety ▩ Emission Control

When To Perform Services	Item No.	Services (For Details, See Numbered Paragraphs)	Mileage When Service Is To Be Performed † 6	12	18	24	30	36	42	48
Every 4 months or 6,000 miles	1	Chassis Lubrication	X	X	X	X	X	X	X	X
	2	*▲Fluid Levels	X	X	X	X	X	X	X	X
	3	*Engine Oil	X	X	X	X	X	X	X	X
	4	Air Conditioning System	X	X	X	X	X	X	X	X
Every 6,000 miles	5	Tire Rotation	X	X	X	X	X	X	X	X
At 1st oil change–then every 2nd	6	*Engine Oil Filter	X		X		X		X	
See Explanation	7	Rear Axle & Final Drive Fluid								
Every 12 months or 12,000 miles	8	*Cooling System		X		X		X		X
Every 24,000 miles	9	Final Drive Axle Boots & Output Shaft Seals				X				X
See Explanation	10	Wheel Bearings								
Every 100,000 miles	11	*Automatic Transmission Fluid								
Every 4 months or 6,000 miles	12	Owner Safety Checks	X	X	X	X	X	X	X	X
	13	Tires and Wheels	X	X	X	X	X	X	X	X
	14	Exhaust System	X	X	X	X	X	X	X	X
	15	*Engine Drive Belts	X	X	X	X	X	X	X	X
	16	Suspension and Steering	X	X	X	X	X	X	X	X
	17	Brakes and Power Steering	X	X	X	X	X	X	X	X
Every 6,000 miles	18	Disc Brakes	X	X	X	X	X	X	X	X
Every 12 months or 12,000 miles	19	Drum Brakes and Parking Brake		X		X		X		X
	20	Throttle Linkage		X		X		X		X
	21	Headlights		X		X		X		X
	22	Underbody		X		X		X		X
	23	Bumpers		X		X		X		X
At 1st 4 months or 6,000 miles–then at 12 month/12,000 mile intervals	24	Thermostatically Controlled Air Cleaner	X	X		X		X		X
	25	Carburetor Choke	X	X		X		X		X
	26	Timing, Dwell, Carb. Idle, Dist. & Coil	X	X		X		X		X
At 1st 4 mos. or 6,000 miles	27	Carburetor Mounting	X			X				X
Every 6,000 miles	28	Spark Plugs (Vehicles using leaded fuels)	X	X	X	X	X	X	X	X
Every 12 months or 12,000 miles	29	EGR System (Vehicles using leaded fuels)		X		X		X		X
	30	Fuel Pump Filter		X		X		X		X
	31	Thermal Vacuum Switch and Hoses		X		X		X		X
	32	Idle Stop Solenoid		X		X		X		X
	33	PCV System		X		X		X		X
Every 24 months or 24,000 miles	34	Engine Compression				X				X
	35	ECS System				X				X
	36	Fuel Cap, Lines, and Tank				X				X
	37	AIR System				X				X
Every 24,000 miles	38	Air Cleaner Element				X				X
At 1st 24/24–then every 12/12	39	Spark Plug & Ignition Coil Wires				X		X		X

*Also an Emission Control Service ▲Also a Safety Service †Figures represent miles in thousands

The lower spherical joint on c-cars is inspected for wear visually as described in Section 3, Note 7B.

The procedure for replacing and repacking the upper and lower suspension arm spherical joint seals is described in Section 3. The procedure for replacing and repacking inner and outer steering linkage tie rod pivots is described in Section 9.

If a loose joint is found, replace the joint.

No lubrication is required at the generator; water pump; propeller shaft bearings; driven wheel bearings; upper and lower rear control arms; rear springs; shackles, or spring liners on Seventy-Five and Commercial Chassis; starter motor; speedometer cable; Automatic Level Control Compressor; or front or rear bumper Energy Absorbing Devices, as all of these are packed with sufficient lubricant at time of assembly.

The propeller shaft does not require maintenance on a regularly scheduled basis. Whenever the shaft is disconnected at the transmission, lubricate the outside diameter of the front propeller shaft yoke with Automatic Transmission Fluid, and the inside diameter with propeller shaft slip yoke lubricant, or an equivalent lubricant.

The moveable mechanical parts of the body are

lubricated during production to insure proper and quiet operation. If additional lubrication is required, lubricants should be used according to the directions in Section 2 of the body service manual.

[2.] **FLUID LEVELS**–Check level of fluid in brake master cylinder ▲, power steering pump ▲, battery, engine*, axle, transmission* and windshield washer▲. Engine coolant should be checked for proper level and freeze protection to at least -40°F. or to the lowest temperature expected during the period of vehicle operation.* Proper engine coolant also provides corrosion protection.

The battery electrolyte level should be checked at every engine oil change. In warm weather, a check should be made at two-week intervals.

CAUTION: Do not overfill battery or add any substance to fluid except colorless, odorless drinking water.

When replacing battery cables retorque screws to 70 inch-pounds.

CAUTION: Over torquing terminal screws may strip threads in terminal or short out battery. Use only 3/8-16 x 1 coarse thread screws.

Keep battery, cable terminals, and hold-down bracket clean. If necessary, clean with a solution of ammonia and water, or baking soda and water. Flush off with water and apply petroleum jelly to cable screws and terminals to retard corrosion.

CAUTION: Never expose battery to open flame or electric spark – battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact skin, eyes, fabrics, or painted surfaces – fluid is a sulfuric acid solution which could cause serious personal injury or property damage. Wear eye protection when working with battery. Remove rings, metal watchbands and other metal jewelry before jump starting or working around a battery, and be careful in using metal tools – if such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the car, a short circuit may occur which could cause personal injury.

Any significant fluid loss in any of these systems or units could mean that a malfunction is developing and corrective action should be taken immediately. A low fluid level in the brake master cylinder front reservoir could also be an indicator that the disc brake pads need to be replaced.

An Engine Oil Change Interval and Viscosity Chart, and a Fluid Capacity Chart appear at the end of this section.

[3.] **ENGINE OIL***–Change each 4 months or 6,000 miles, whichever occurs first, or each 2 months or 3,000 miles when the vehicle is operated under the following conditions: (a) driving in dusty conditions, (b) trailer pulling, (c) extensive idling or (d) short-trip operation at freezing temperatures (with engine not thoroughly warmed-up).

The original factory fill oil will perform satisfactorily during the normal change interval specified on the Engine Oil Change Interval and Viscosity Chart located at the back of this section, because this oil meets the specifications for service "SE". The same chart should also be consulted for factory recommendations if additional oil should be necessary prior to the normal change interval.

The use of proper engine oil is the best assurance of continued reliability and performance from a Cadillac engine. Cadillac does not recommend oils by brand name, as assurance of oil quality is the responsibility of the refiner. Instead, the factory recommends oils that, according to their labels, are intended for service "SE". Cadillac Servicemen should assist owners in the selection of the proper oil that meets the above requirements, as well as the proper viscosity number for a particular area and season.

In areas where the temperature seldom drops below zero, most 10W or 10W-40 oils are satisfactory for easy starting of the engine. When the temperature is frequently near or below zero, a 5W-20 or 5W-30 oil is recommended.

(NOTE: 5W-20 oils are not recommended for sustained high speed driving. Non detergent and low quality oils are specifically not recommended for any type of service.)

Always maintain the correct oil level. Oil should be added only when the level reaches the "Add One Quart" mark on the dipstick. Do NOT add oil if oil level is above the "Add 1 Qt" line, or foaming may result. For an accurate check of oil level wait 10 to 15 minutes after shutting off engine to allow time for oil to drain back into pan. Always check engine oil level when engine is hot.

Engine oil is added by removing the oil filler cap on the right rocker arm cover.

The engine should be drained of oil only after it has been warmed to normal operating temperature. The benefits of draining are minimized if the crankcase is drained when the engine is cold, as some suspended foreign matter will cling to the internal engine parts and will not drain with the slower moving colder oil.

The capacity is 4 quarts (5 quarts on Eldorado). Do not add more than 4 quarts except when changing oil filter in which case 5 quarts should be used (6 quarts on Eldorado). It is unnecessary to change the oil for the occasional unseasonably cold or warm day encountered during the fall or spring season.

(NOTE: The Eldorado engine has two oil pan drain plugs which must be opened when changing oil.)

[4.] **AIR CONDITIONING**–Check condition of air conditioning system hoses and refrigerant charge at sight glass. Replace hoses and/or refrigerant if need is indicated.

The 6 cylinder compressor uses 525 viscosity oil. It is important that only the type of oil recommended by the compressor manufacturer be used. Refer to Section 1 for lubricating recommendations.

[5.] **TIRES**–To equalize wear, rotate tires and adjust tire pressure as illustrated in Section 10.

[6.] **ENGINE OIL FILTER***–Replace at the first oil changed and every other oil change thereafter. The

engine oil filter is of the spin-on, full-flow type.

The full-flow type oil filter filters 100% of the oil delivered by the oil pump. For this reason, it is very important that the recommended oil filter change intervals be followed.

The oil filter is mounted on the front right side of the engine. Access to the filter is gained from under the car. Replacement procedure is as follows:

1. Position car on hoist.
2. Unscrew filter from base and discard.
3. Wipe gasket area of base clean.
4. Place a light film of silicone on top of gasket and screw filter on stud of filter base by hand until gasket touches filter base. Then tighten element an additional 2/3 of a turn.
5. Add 1 quart of oil to engine crankcase.

(NOTE: If engine oil is changed in conjunction with oil filter replacement, add a total of 5 quarts of oil to engine crankcase (6 on Eldorado).)

6. Operate engine at fast idle and check for oil leaks at filter base.
7. After engine has run for 3 to 4 minutes, stop engine and check oil level.

7. **REAR AXLE AND FINAL DRIVE**–Change lubricant every 12,000 miles on all type rear axles or final drives when using vehicle to pull a trailer, when performing service operations inside the differential or if replacement of the final drive is necessary.

Check the lubricant level only at the first inspection and add lubricant if necessary. The lubricant level should be within 1/2 inch of the lower edge of the filler hole. Each spring and fall, inspect for signs of external leakage and check lubricant level only if leakage is evident.

Either SAE 80 or SAE 90 GL-5 multi-purpose type gear lubricant conforming to MIL-L-2105-B specifications or the controlled differential lubricant can be used for cars equipped with the standard differential. Cars equipped with the Controlled Differential should use only the special lubricant, Part Number 1050189, or its equivalent, to assure the satisfactory operation of this unit.

The factory recommended fluid for the final drive assembly is either SAE 80 or SAE 90 GL-5 multi-purpose type gear lubricant conforming to MIL-L-2105-B specifications.

For vehicles normally operated in Canada, SAE 80 GL-5 gear lubricant is recommended.

When removing the filler plug, take extreme care not to allow any dirt to enter the filler hole.

8. **COOLING SYSTEM**–At 12-month or 12,000-mile intervals, wash radiator cap and filler neck with clean water, pressure test system and radiator cap for proper pressure holding capacity, (tighten hose clamps and inspect condition of all cooling and heater hoses*). Replace hoses every 24 months or 24,000 miles or earlier if checked, swollen or otherwise deteriorated.

Also each 12 months or 12,000 miles, clean exterior of radiator core and air conditioning condenser.* Light brushing and reverse air flow is usually a satisfactory cleaning method. Insects can usually be removed with a garden hose using light water pressure.

Engine coolant should be checked for proper level and for corrosion protection to at least -40°F and for freeze protection to the lowest temperature expected during the period of vehicle operation. Every 24 months or 24,000 miles, drain, flush, and refill the cooling system with ethylene glycol base coolant.

(NOTE: Supplemental inhibitors or additives claiming to provide increased cooling capability that have not been specifically approved by GM are not recommended for addition to the cooling system. These additives may be detrimental to the efficient operation of the system, and they represent an unnecessary operating expense.)

9. **ELDORADO FINAL DRIVE AXLE BOOTS & OUTPUT SHAFT SEALS**–Check for damaged, torn or leaking boots on drive axles and for leaking output shaft seal. Replace defective parts as necessary. Refer to Section 3.

10. **WHEEL BEARINGS**–Clean and repack front wheel bearings (rear on Eldorado) with a #2 grade lithium high melting point wheel bearing grease free from any fillers or abrasives. Refer to Section 3 for repacking procedure.

11. **AUTOMATIC TRANSMISSION FLUID***–Under normal driving conditions, change the transmission fluid and service the sump filter every 100,000 miles. Under unusual conditions such as constant driving in heavy city traffic during hot weather, trailer pulling, etc., this service should be performed at 50,000-mile intervals. DEXRON® or DEXRON® -II Automatic Transmission Fluid or fluid of equivalent quality is recommended exclusively for use in Cadillac automatic transmissions. It should be used both for adding and refilling. DEXRON® or DEXRON® -II fluid or its equivalent incorporates additives not used in regular fluid-additives that are essential for satisfactory transmission performance. Fluid of this quality is distributed by General Motors and by other oil marketers.

Fluid replacement procedure is as follows:

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the filler tube. Remove enough transmission fluid so that bottom pan will not overflow when removed.
2. Raise car and remove bottom pan. Empty pan and clean with solvent.
3. Install bottom pan using a new gasket.
4. Lower car and add 2 quarts (4 quarts on Eldorado) of transmission fluid through filler tube.
5. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
6. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level.

The oil intake system incorporates an oil filter in the transmission oil sump. The filter must be replaced after the first 100,000 miles only, or after a major transmission malfunction. The procedure for removing and installing the filter is described in Section 7, Note 6c.

The transmission dipstick and filler tube is located on the right side of the engine (left side on the Eldorado).

Fluid level should be checked at every engine oil change. Add fluid, if necessary, until proper level is indicated on dipstick. Proper fluid level is based on oper-

ating temperature. See Figs. in Section 7. At normal operating temperature, 1 pint of fluid will change the level from the low mark to the full mark on the dipstick.

When checking fluid level, first run engine at 800 rpm with shift lever in Park "P" position for 1-1/2 minutes to make certain converter is full. Reduce engine speed to slow idle, remove and wipe dipstick, then check fluid level. With the engine still running, add fluid through dipstick tube to bring fluid to proper level.

CAUTION: Do not overfill, as foaming may occur when fluid heats up. If fluid level is too low, especially when cold, complete loss of drive may result after quick stops. Extremely low fluid levels will result in damage to the transmission.

Safety Maintenance

12. SAFETY CHECKS TO BE PERFORMED BY OWNER–Listed below are the safety checks that should be made by the owner (items A through T). These checks should be made regularly during operation and at no greater interval than 4 months or 6,000 miles, whichever occurs first, and more often when the need is indicated. Any deficiencies should be brought to the attention of a dealer or another service outlet, as soon as possible, so the advice of a qualified mechanic is available regarding the need for repairs or replacements.

A. STEERING COLUMN LOCK–Check for proper operation by attempting to turn key to LOCK position in the various transmission gears with car stationary. Key should turn to LOCK position only when transmission control is in PARK. Key should be removable only in LOCK position.

B. PARKING BRAKE AND TRANSMISSION "PARK" MECHANISM–Check parking brake holding ability by parking on a fairly steep hill and restraining the vehicle with the parking brake only. Check the holding ability of the park mechanism by releasing all brakes after the transmission selector lever has been placed in the "P" position.

CAUTION: Before making the check below, be sure to have a clear distance ahead and behind the car, set the parking brake and firmly apply the foot brake. Do not depress accelerator pedal. Be prepared to turn off ignition switch immediately if engine should start.

C. STARTER SAFETY MECHANISM–Check starter safety mechanism by placing the transmission in each of the driving gears while attempting to start the engine. The starter should operate only in the Park ("P") or Neutral ("N") positions.

D. TRANSMISSION SHIFT INDICATOR–Check to be sure automatic transmission shift indicator accurately indicates the shift position selected.

E. STEERING–Be alert to any changes in steering action. The need for inspection or servicing may be indicated by "hard" steering, excessive free play or unusual sounds when turning or parking.

F. WHEEL ALIGNMENT AND BALANCE–In addition to abnormal tire wear, the need for wheel alignment service may be indicated by a pull to the right or left when driving on a straight and level road. The need for wheel balancing is usually indicated by a vibration of the steering wheel or seat while driving at normal highway speeds.

G. BRAKES–Be alert to illumination of the brake warning light or changes in braking action, such as repeated pulling to one side, unusual sounds when braking or increased brake pedal travel. Any of these could indicate the need for brake system inspection and/or service.

H. EXHAUST SYSTEM–Be alert to any change in the sound of the exhaust system or a smell of fumes which may indicate a leak. (See also item 14 in this manual.)

I. WINDSHIELD WIPERS AND WASHERS–Check operation of wipers, as well as condition and alignment of wiper blades. Check amount and direction of fluid sprayed by washers during use.

J. DEFROSTERS–Check performance by moving controls to "DEFROST" or "DEF" and noting amount of air directed against the windshield.

K. REARVIEW MIRRORS AND SUN VISORS–Check that friction joints are properly adjusted to mirrors and sun visors stay in the selected position.

L. HORN–Blow the horn occasionally to be sure that it works.

M. LAP AND SHOULDER BELTS–Check belts, buckles, adjustable latch plates, retractors, interlock and reminder systems, guide loops, clips and anchors for cuts, fraying or weakened portions, loose connections, damage, and for proper operation. Check to make certain that anchor mounting bolts are tight.

N. HEAD RESTRAINTS–Check that head restraints adjust properly in the up detent positions, and that no components are missing, damaged or loose.

O. SEAT BACK LATCHES–Check to see that seat back latches are holding by pulling forward on the top of each folding seat back (with doors closed if equipped with automatic seat back latches).

P. LIGHTS AND BUZZERS–Check all instrument panel illuminating and warning lights, seat belt reminder light and buzzer, ignition key buzzer, interior lights, license plate lights, side marker lights, headlamps, parking lamps, tail lamps, brake lights, turn signals, backup lamps, and hazard warning flashers. Have someone observe operation of each exterior light while you activate the controls. The replacement of instrument panel warning lights is covered in Section 12.

Q. GLASS–Check for broken, scratched, dirty or damaged glass on vehicle that could obscure vision or become an injury hazard.

R. DOOR LATCHES–Check for positive closing, latching and locking.

S. HOOD LATCHES–Check to make sure hood closes firmly by lifting on the hood after each closing. Check also for broken, damaged or missing parts which might prevent secure latching.

T. FLUID LEAKS–Check for fuel, water, oil or

other fluid leaks by observing the ground beneath the vehicle after it has been parked for a while. (Water dripping from air conditioning system after use is normal.) If gasoline fumes or fluid are noticed at any time, the cause should be determined and corrected without delay because of the possibility of fire.

13. TIRES AND WHEELS–Check tires for excessive wear, nails, glass, cuts or other damage. Make certain wheels are not bent or cracked and wheel nuts are tight. Uneven or abnormal tire wear may indicate the need for alignment service. Tire inflation pressure should be checked by the owner at least monthly, or more often if daily visual inspection indicates the need. Refer to Section 10 for recommended pressures and information on tire tread wear.

Also, see vibration complaints and corrections listed in this section.

14. EXHAUST SYSTEM–Check complete exhaust system and nearby body areas and trunk lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the trunk or passenger compartment. Dust or water in the trunk may be an indication of a problem in one of these areas. Any defects should be corrected immediately. To help insure continued integrity, exhaust system pipes and resonators rearward of the muffler must be replaced whenever a new muffler is installed.

15. ENGINE DRIVE BELTS*–Check belts driving fan, AIR pump, generator, power steering pump and air conditioning compressor for cracks, fraying, wear and tension*. Adjust or replace as necessary.

It is recommended that belts be replaced every 24 months or 24,000 miles, whichever occurs first.

16. SUSPENSION AND STEERING–Check for damaged, loose or missing parts, or parts showing visible signs of excessive wear or lack of lubrication in front and rear suspension and steering system. Questionable parts should be replaced.

17. BRAKES AND POWER STEERING–Check lines and hoses for proper attachment, leaks, cracks, chafing, deterioration, etc. Any questionable parts should be replaced or repaired immediately. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

The steering gear is lubricated by the power steering fluid and requires no other lubricant. The fluid level in the pump reservoir should be checked every spring and fall after the engine is warm, and the reservoir kept filled with special power steering fluid, Part Number 1050017, or its equivalent. If the dipstick indicates that the fluid level is extremely low, the unit should be inspected for leaks and corrected immediately. When making a complete fluid change, always use special power steering fluid available from servicing parts warehouses. When topping off the fluid, if the special fluid is not available, DEXRON® or DEXRON® II Transmission Fluid or equivalent may be used. Refer to Section 9 for checking fluid level.

18. DISC BRAKES–Be alert for disc brake wear indicator sound. (See Section 5 for descriptive details). Check brake pads and condition of rotors while wheels are removed during tire rotation. (Note below regarding more frequent checks also applies to disc brakes.)

The brake fluid level of both sections of the master cylinder should be checked at every engine oil change and every time the brakes are serviced. The reservoir cover incorporates a diaphragm that provides a seal between the reservoir fluid and the atmosphere to prevent moisture absorption or dust contamination.

If either the front or rear brake reservoir is found to be low, the related hydraulic system should be checked for leaks. Then fill the reservoir with Super Heavy Duty Brake Fluid, Part Number 5464831, or equivalent fluids conforming to SAE J-1703 specifications, to within 1/8 inch to 3/8 inch of the reservoir sealing surface.

Check travel of service brake pedal and the parking brake pedal every 4 months never to exceed 6,000 miles. Excessive brake pedal travel is an indication of the air in the fluid or some other brake system malfunction.

Service brake pedal travel should not exceed 1-3/4 inch during normal brake pedal application of approximately 30 pounds force (2" on Eldorado).

Refer to Section 5 for adjustment procedures should pedal travel be found incorrect.

19. DRUM BRAKES AND PARKING BRAKE–Check drum brake linings and other internal brake components at each wheel (drums, wheel cylinders, etc.). Parking brake adjustment also should be checked for drag and mechanism lubricated at every chassis lubrication. The parking brake pedal should travel 1-3/4 inch to 2-3/4 inch with moderate application (50 pounds force).

(NOTE: More frequent checks should be made if driving conditions and habits result in frequent brake application.)

20. THROTTLE LINKAGE–Check for damaged or missing parts, interference or binding. Any deficiencies should be corrected.

21. HEADLIGHTS–Check for proper aim. Correct as necessary. More frequent checks should be made if oncoming motorists signal when you are already using your low beams, or if illumination of the area ahead seems inadequate.

22. UNDERBODY–In geographic areas using a heavy concentration of road salt or other corrosive materials for snow removal or road dust control, flush and inspect the complete under side of the car at least once each year, preferably after a winter's exposure. Particular attention should be given to cleaning out underbody members where dirt and other foreign materials may have collected.

(NOTE: Undercoating should not be applied to any moving or rotating part. It should be kept off bumper energy absorbers, steering damper (Eldorado), shock absorbers, air conditioner fittings, body drainholes, exhaust system, propeller shaft, component vents and air filters. On cars equipped with Automatic Level Control, particular care should be taken not to undercoat any fittings, lines, or system components.)

23. BUMPERS–Check the front and rear bumper systems at 12-month/12,000-mile intervals to be sure the impact protection and clearance originally designed into these systems remain in a state of full readiness. It also

should be checked whenever there is obvious bumper misalignment, or whenever the vehicle has been involved in a significant collision in which the bumper was struck, even when slight or no damage to the bumper system can be seen.

Emission Control Maintenance

The Federal Clean Air Act stipulates that it is unlawful for any person to remove or render inoperative any device or element of design on a motor vehicle in compliance with regulations. A further provision stipulates that "the manufacturer shall furnish with each new Motor vehicle" . . . "written instructions for the maintenance and use of the vehicle or engine by the ultimate purchaser as may be reasonable and necessary to assure the proper functioning of emission control devices and systems."

24. THERMOSTATICALLY CONTROLLED AIR CLEANER–Inspect installation to make certain that all hoses and ducts are connected and correctly installed. Operational function should be checked as described in Section 6.

25. CARBURETOR CHOKE–Check vacuum re-indexing choke mechanism for free operation. Any binding condition which may have developed due to petroleum gum formation on the choke shaft or from damage should be corrected. Choke shafts can usually be cleaned without disassembly by using X-66 Carburetor Conditioner or equivalent. The vacuum hose must be in good condition, correctly installed and fit tightly.

26. TIMING, DWELL, CARBURETOR IDLE, DISTRIBUTOR & COIL–Ignition timing, dwell and carburetor idle should be adjusted accurately (following the specifications and procedures described in Section 6, and on the label under the hood) at the first 4 months or 6,000 miles of operation, then at 12 month or 12,000 mile intervals. Adjustments must be made with test equipment known to be accurate.

Replace distributor points (except cars equipped with High Energy Ignition) every 12 months of 12,000 miles and replace cam lubricator every 24 months or 24,000 miles. Points in good condition may be reused after readjustment and the rotation or replacement of the cam lubricator.

The Cadillac distriburor is permanently lubricated and requires no periodic oiling. However, in the event the distributor is disassembled and the shaft or breaker plate is removed, the wick in the oil reservoir should be moistened with light weight engine oil.

Inspect the interior and exterior of the distributor cap, distributor rotor and coil for cracks, carbon tracking, and terminal corrosion. Clean or replace as necessary at 24-month/24,000-mile intervals to prevent misfiring and/or deterioration.

Proper functioning of the carburetor is particularly essential to control of emissions. Correct mixtures for emission compliance and idle quality have been preset by Cadillac. Plastic idle mixture limiters have been installed on the idle mixture screws to discourage unauthorized adjustment. these idle limiters are not to be removed unless some major carburetor repair or replacement which affects the idle screw adjustment has been necessary.

At 24 month or 24,000 mile intervals or in case of a major carburetor overhaul, or when poor idle quality exists, idle mixture should be adjusted by use of a CO meter when an accurate meter is available. If an accurate CO meter is not available the alternate mechanical method (lean drop) should be used to adjust idle mixture.

27. CARBURETOR MOUNTING–Torque carburetor attaching screws to compensate for compression of gasket at first 4 months or 6,000 miles of vehicle operation, at 24,000 miles, and at every 24,000 miles thereafter.

28. SPARK PLUGS–Replace every 6,000 miles when using leaded fuels or every 12,000 miles when using low lead or unleaded fuels. If equipped with High Energy Ignition, using unleaded fuel, replace plugs every 24,000 miles. Leaded fuels create lead deposits on spark plugs and can cause misfiring before 12,000 miles. Where misfiring occurs before 6,000 miles, spark plugs in good condition can be cleaned and reused.

29. EXHAUST GAS RECIRCULATION SYSTEM (EGR)–At 12 month/12,000 mile intervals when operating with leaded fuels or at 24 month/24,000 mile intervals when using unleaded fuels. Remove, inspect and if deposits exist, clean the EGR valve. Inspect the EGR passages in the inlet manifold and clean as required. A damaged EGR valve must be repaired or replaced.

30. FUEL PUMP FILTER–Replace filter at 12-month/12,000-mile intervals or more frequently if clogged.

31. THERMAL VACUUM SWITCH AND HOSES–The thermal vacuum switch should be tested every 12 months or 12,000 miles as described in Section 6. Vacuum control hoses must be in good condition, correctly installed and fit tightly.

32. IDLE STOP SOLENOID–Check for proper operation every 12 months or 12,000 miles. Replace solenoid if inoperative.

33. POSITIVE CRANKCASE VENTILATION SYSTEM (PCV)–Clean the filter and check the PCV system for satisfactory operation at 12-month or 12,000-mile intervals using a tester. Replace the PCV valve at 24-month or 24,000-mile intervals and blow out PCV valve hose with compressed air. The PCV valve should be replaced at 12-month or 12,000-mile intervals when the vehicle is used in operations involving heavy dust, extensive idling, trailer pulling, and short trip use at freezing temperatures where engine does not become thoroughly warmed-up.

Cleaning of the crankcase ventilating breather is important in order to provide proper crankcase breathing. The breather is located on the left rocker arm cover. The filtering material in the unit must be cleaned with solvent at every oil filter change. Do not oil the filtering element.

34. ENGINE COMPRESSION–This test should be performed to provide reasonable assurance that engine condition is sufficiently efficient to prevent leakage of unburned gases. Check compression every 24 months or 24,000 miles.

Minimum compression recorded in any one cylinder should not be less than 70% of highest cylinder. For example, if the highest pressure in any one cylinder is 150 pounds, the lowest allowable pressure for any other cylinder would be 105 pounds (150 x 70% = 105).

35. EVAPORATION CONTROL SYSTEM (ECS)–Check all fuel and vapor lines and hoses for proper connections and correct routing as well as condition.

Check canister for cracks or damage when replacing the canister filter. Replace filter every 24 months or 24,000 miles. Replace damaged or deteriorated parts as necessary.

36. FUEL CAP, FUEL LINES AND FUEL TANK–Inspect the fuel tank, cap and lines for damage which could cause leakage. Inspect fuel cap for correct sealing ability and indications of physical damage. Replace any damaged or malfunctioning parts.

37. AIR INJECTION REACTOR (AIR) SYSTEM HOSES AND CONNECTIONS–Check AIR system hoses and fittings for loose connections and deterioration. Test diverter valve by quickly depressing and releasing throttle and holding hand under diverter valve exhaust. If exhausted air can be felt during engine deceleration, valve is operating properly. Inoperative diverter valves should be replaced.

38. AIR CLEANER ELEMENT–Replace the engine air cleaner element under normal operating conditions every 24,000 miles. Operation of vehicle in dusty areas will necessitate more frequent element replacement. A visual inspection of the element is recommended periodically to make certain that it is properly seated and that there is no indication of dust leakage. If dirt or damage is indicated at time of visual inspection, the element should be replaced. To replace element, proceed as follows:

1. Remove cover from carburetor air cleaner.
2. Remove element and discard.
3. Wipe all dirt from inside air cleaner cover.
4. Remove base, wipe clean and reinstall.
5. Install a new element on air cleaner base, making certain that it is properly seated and replace air cleaner cover.

CAUTION: Do not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the air cleaner is removed, backfiring can cause fire in the engine compartment.

39. SPARK PLUG AND IGNITION COIL WIRES–Inspect spark plug and ignition coil wires for evidence of checking, burning, or cracking of exterior insulation and tight fit at distributor cap, coil, and spark plugs. Exterior of wires should be cleaned; any evidence of corrosion on end terminals removed and wire replaced if deteriorated. Check should be made after first 24 months or 24,000 miles and at every 12 month/12,000 miles thereafter.

RECOMMENDED FLUIDS & LUBRICANTS

USAGE	FLUID/LUBRICANT
Power steering system and pump reservoir	GM power steering fluid–if not available use DEXRON® or DEXRON® II automatic transmission fluid
Differential–standard	SAE-80 or SAE-90 GL-5 gear lubricant (SAE-80 in Canada)
Differential–Controlled	Special Lubricant; Part Number 1050189 or equivalent
Brake system and master cyl.	Delco Supreme 11 or DOT-3 fluids
Hood latch assembly a. Pivots and spring anchor	Engine oil
b. Release pawl	Chassis grease
Hood hinges	Engine oil
Automatic transmission shift linkage	Engine oil
Chassis lubrication	Special long-life lubricant if suspension or steering connections (except idler arm) are serviced. Use chassis grease for idler arm
Automatic transmission	DEXRON® or DEXRON® II automatic transmission fluid
Parking brake cables	Chassis grease
Front wheel bearings (rear on Eldorado)	#2 Grade Lithium high melting point wheel bearing grease
Body door hinge pins, fuel door hinge, rear compartment lid hinges	Engine oil
Convertible door-to-lock wedge plates	Stick-type lubricant
Winshield washer solvent	GM Optikleen washer solvent or equivalent
Battery	Colorless, odorless, drinking water

RECOMMENDED FLUIDS & LUBRICANTS CONTINUED

Engine coolant	50-50 mixture of water and a high quality Ethylene Glycol base type anti-freeze conforming to GM Spec. 1899-M
Propeller shaft front slip yoke	Outside–transmission fluid inside and between transmission oil seal lips–synthetic oil seal lubricant, Part Number 1050169, or its equivalent
Engine fuel	"No Lead, "Low Lead" or regular grade gasoline having a research octane number of 91 or higher (Cost of Living Council method - 87 octane quality or higher)
Air conditioning system lubricant	525 viscosity refrigeration oil
Refrigerant	Refrigerant "12"

ENGINE OIL CHANGE INTERVAL AND VISCOSITY CHART

ENGINE OIL RECOMMENDATION

Use only high quality oils intended for service "SE". The chart below will serve as a guide for selecting proper oil viscosity. Change oil every 4 months never to exceed 6,000 miles.

Change oil each 2 months or 3,000 miles, whichever occurs first, under the following conditions: Driving in dusty areas, trailer towing, extensive idling, short trip operation (engine not thoroughly warmed up).

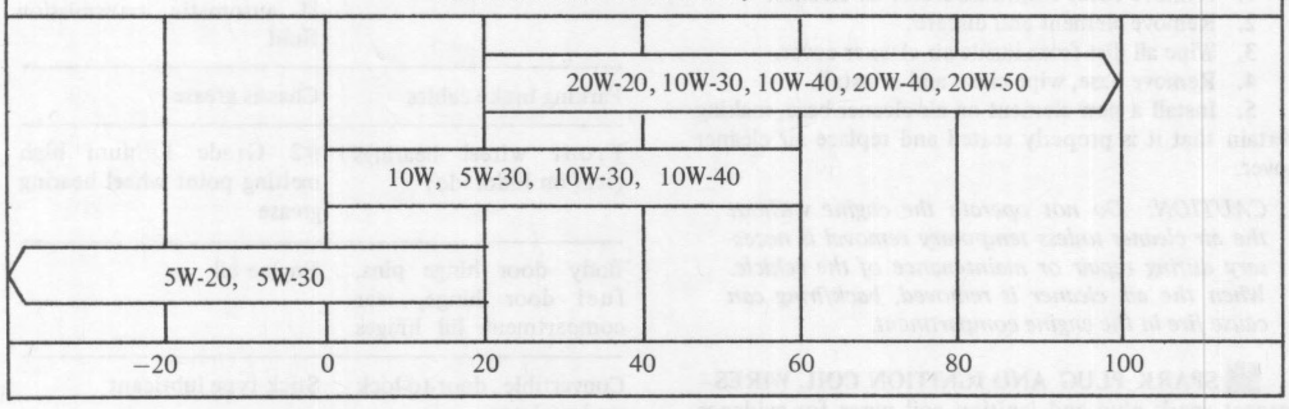
OIL VISCOSITY PRECAUTIONS

SAE 5W-20 oils are not recommended for sustained high-speed driving.

SAE 30 oils may be used at temperatures above 40°F.

SAE 5W-30 viscosity oils recommended for vehicles normally operated in Canada.

Recommended SAE Viscosity Number



Temperature range anticipated before next oil change, °F.

FLUID CAPACITIES

All Series Unless Otherwise Noted	U.S. Measure	Imperial Measure	Metric Measure
Engine Oil			
All (Except Eldorado)	4 Quarts	3-1/3 Quarts	3.8 Liters
Eldorado Only	5 Quarts	4-1/6 Quarts	4.7 Liters
When Filter is Changed			
All (Except Eldorado)	5 Quarts	4-1/6 Quarts	4.7 Liters
Eldorado Only	6 Quarts	5 Quarts	5.7 Liters
Cooling System			
With Air Conditioning or Trailer Towing Package	23.8 Quarts	19-5/6 Quarts	22.5 Liters
With Heater Only	21.3 Quarts	17-3/4 Quarts	20.2 Liters
75 Series Only	26.8 Quarts	22-1/3 Quarts	25.4 Liters
Air Conditioner - Refrigerant 12	3-3/4 Pounds	3/4 Pounds	1.7 Kilograms
75 Series Only	5 Pounds	5 Pounds	2.3 Kilograms
Air Conditioner Compressor Oil - 525 Viscosity	10-1/2 Fluid Ounces	8-3/4 Ounces	297.7 Grams
75 Series Only	13-1/2 Fluid Ounces	11-1/4 Ounces	382.7 Grams
Rear Axle (Except Eldorado)	5 Pints	4-1/2 Pints	2.4 Liters
Final Drive (Eldorado only)	4 Pints	3-1/3 Pints	1.9 Liters
Gasoline Tank (All Series)	27.5 Gallons (Approx.)	23 Gallons (Approx.)	104.1 Liters (Approx.)
Turbo-Hydra-matic Transmission			
(Except 693)			
Dry	12 Quarts, 1 Pint	10-1/3 Quarts	11.8 Liters
Pan and Filter Removed	4 Quarts	3-1/3 Quarts	3.8 Liters
(Eldorado only)			
Dry	13 Quarts	10-5/6 Quarts	12.3 Liters
Pan and Filter Removed	5 Quarts	4-1/6 Quarts	4.7 Liters

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GENERAL DESCRIPTION

The purpose of the seat belt starter interlock and warning system, is to prevent initial engine start until the driver and front outboard seat passenger have occupied the seat cushion and then engaged their respective seat belt buckles.

The seat sensor switch must be actuated by sitting down prior to engaging the related seat belt buckle switch. Prior to initial start, if the outboard seat sensors and related buckle switches are engaged out of sequence, the interlock relay will prevent starter operation and the reminder light and buzzer at the instrument panel will be energized. In addition, after the engine is started, the warning system will be energized if the driver or passengers do not have their seat belt buckle switches engaged with gear selector in a forward drive position, or while engine is being cranked after engine stall.

The components of the Interlock System are listed in the parts locator at the top of each chart.

Vehicles Sold In Canada

Cadillac vehicles sold in Canada will not have the interlock or sequential system incorporated into the 1974 seat belt system. The seat belt system will function the same as on 1973 vehicles except that the center lap belt on the front seat (if applicable to vehicle) will also be connected to the seat belt warning system. All parts used on the Canadian system will be identical to the U.S. version with the exception of the following:

1. Logic Module – The logic module will be replaced with a module which retains the light and buzzer activating provisions, but does not contain the starter interlock mode.
2. Interlock Relay – The interlock relay will be replaced with a jumper.
3. Bypass Relay – The bypass relay and harness connector will be deleted or the harness connector will be fitted with a dust cover.

THEORY OF OPERATION

Initial Start

To start the car, the driver and right front seat passenger must perform the following steps in order:

1. Get in the car and sit down.
2. Buckle the seat belt. (Seat belts at unoccupied positions can be left unbuckled.)
3. Turn the ignition key to START.

The occupant's weight activates a sensor switch inside the seat. Buckling the seat belt activates a switch inside the belt buckle. If the logic module under the seat records sitting down and buckling the seat belt, in that order, the engine will start when the driver turns the key.

Starter Interlock and Reminder Systems

If the seat belts are not buckled, or are buckled before the occupants in the outboard seats are seated, the logic module will activate the interlock relay under the instrument panel which prevents the starter solenoid from engaging and activates the reminder light and buzzer. The light and buzzer will also come on if any front seat occupant unbuckles his seat belt after the transmission is shifted to a forward drive position. The light and buzzer will not come on when the engine is running and a front seat belt is unbuckled if the transmission is in PARK or NEUTRAL.

Bounce

The logic unit includes a bounce feature that keeps the interlock system from preventing a start when a buckled-in occupant momentarily lifts off the seat and deactivates the sensor switch. Without the bounce feature, the logic unit would sense that the occupant left the car and then buckled the seat belt before being reseated. If the occupant is off the switch for longer than five to ten seconds, the seat belts must be unbuckled and rebuckled before the car will start.

Restart

Once the car has been started using the correct starting procedure, it can be restarted with the seat belts unbuckled at occupied front seat positions as long as the driver remains seated. If the driver leaves his seat, the interlock relay will activate and the initial start procedure must then be used to start the car.

Mechanic's Start

The car can be started with the seat belts in any position when the front seats are unoccupied. To start the engine, reach inside the car and turn the ignition key to START without sitting on the seat. The light and buzzer will come on when the front seat is then occupied and the transmission shifted to DRIVE, but will turn off as soon as the seat belts at occupied positions are buckled.

Bypass Relay

A bypass relay on the firewall permits starting the car by bypassing the interlock relay in the event of system malfunction. To activate the relay, turn the ignition key to ON. Then, open the hood and press and release the bypass relay button. THE OVERRIDE MECHANISM WILL BE DAMAGED IF THE BUTTON IS HELD IN THE DEPRESSED POSITION. The engine may then be started by turning the ignition key to START. The relay will remain engaged until the ignition key is turned to OFF or LOCK.

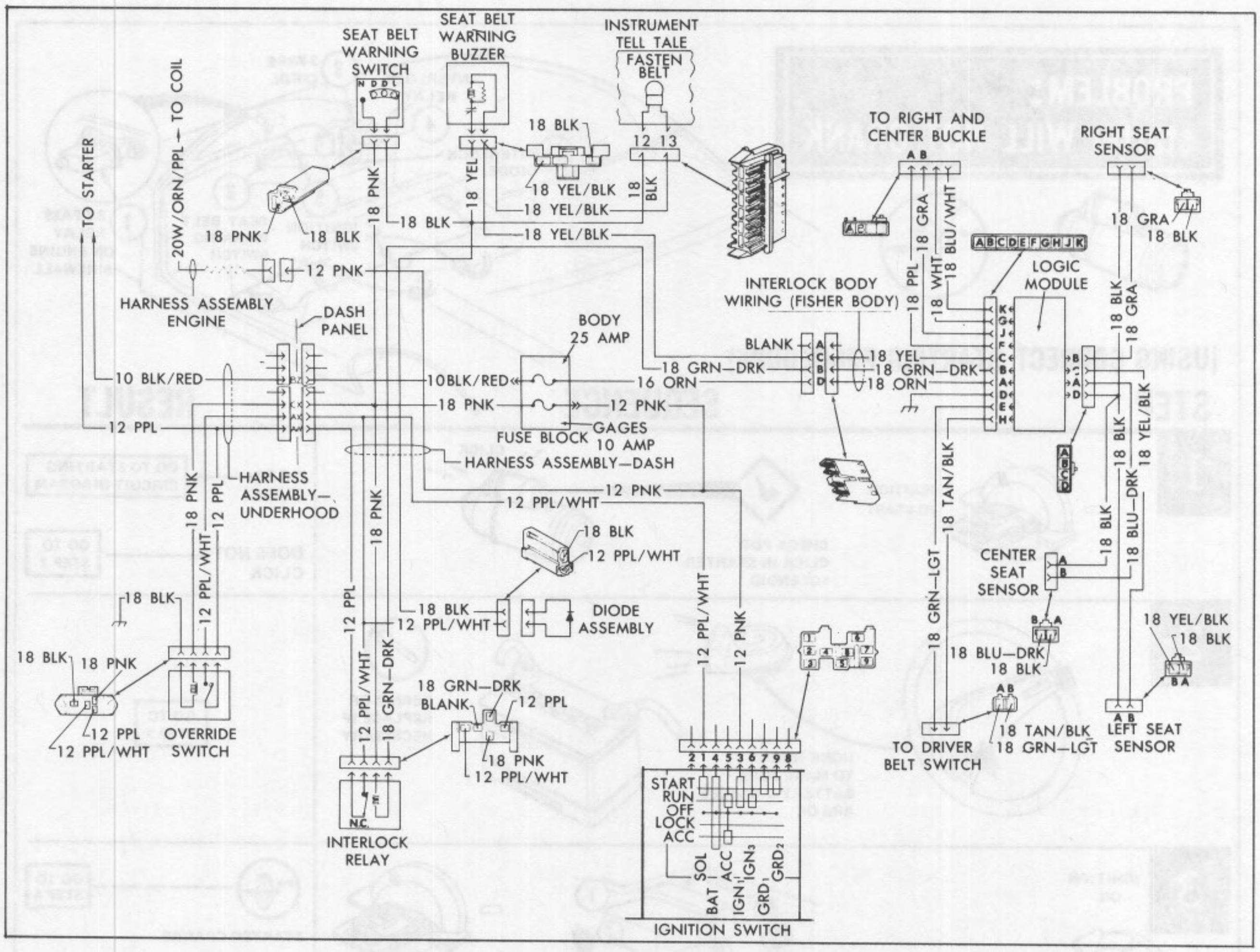
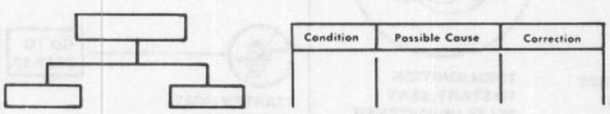


Fig. 1-1 Seat Belt/Starter Interlock Wiring

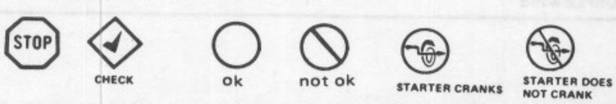
HOW TO USE THE CHARTS

This section presents a systematic method of diagnosing and troubleshooting the seat belt/starter interlock system. The charts you will be using are different from the ones you have used before. They aren't "go —no go" decision trees or tables.



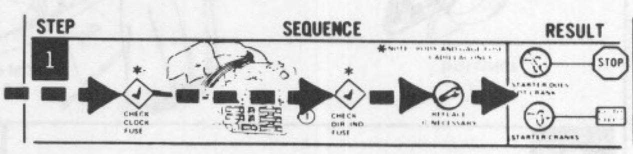
Instead the new diagnosis and troubleshooting charts use pictures plus a few words to help you solve a problem,

and symbols have replaced words.

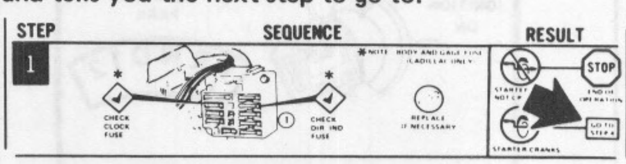


The charts are divided into three sections: step, sequence and result.

Always start at the first step and go through the complete sequence from left to right.

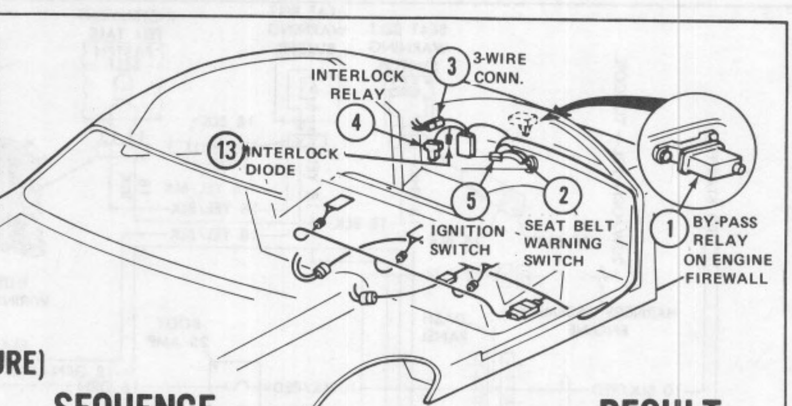


A sequence could be checking the fuses and replacing if necessary. Each sequence ends with a result and tells you the next step to go to.



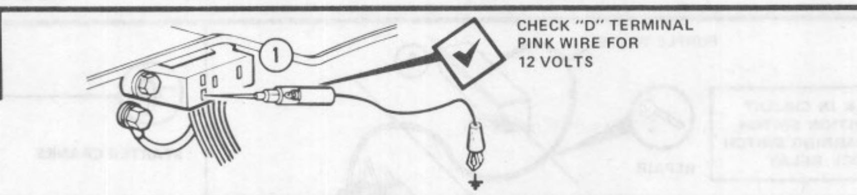
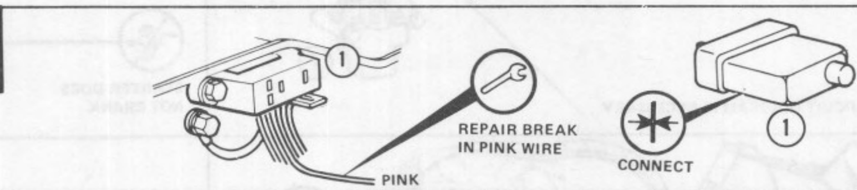
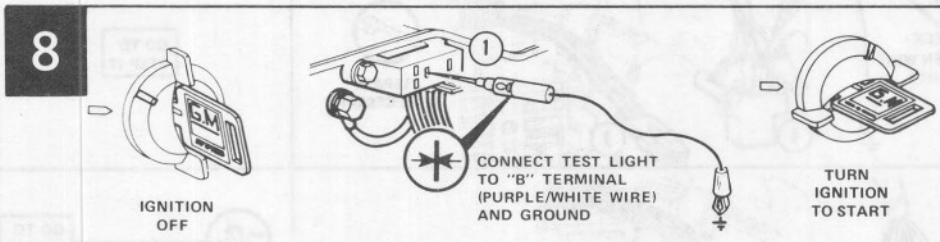
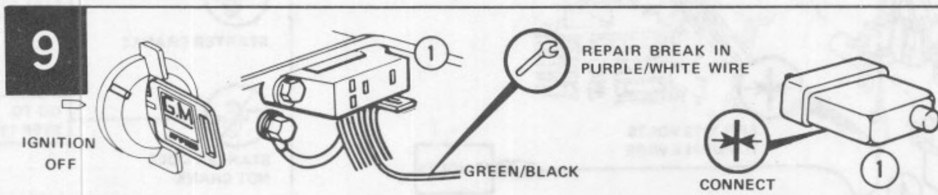
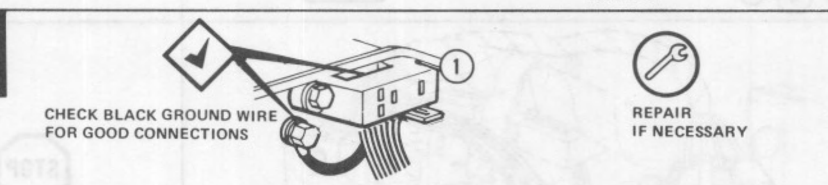
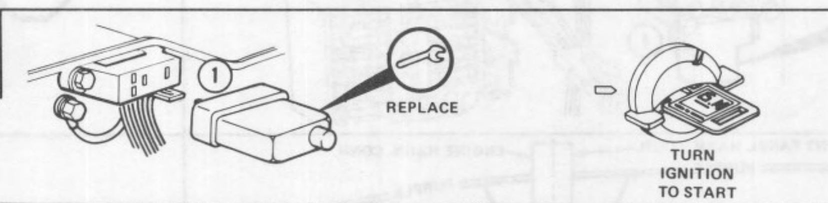
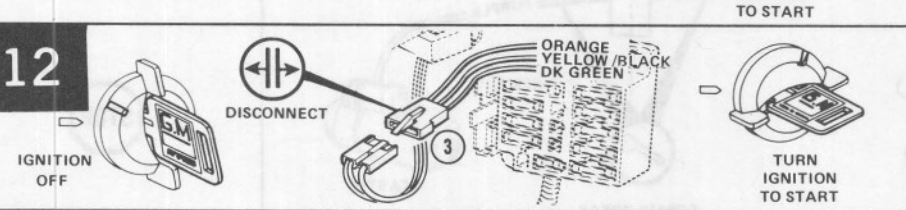
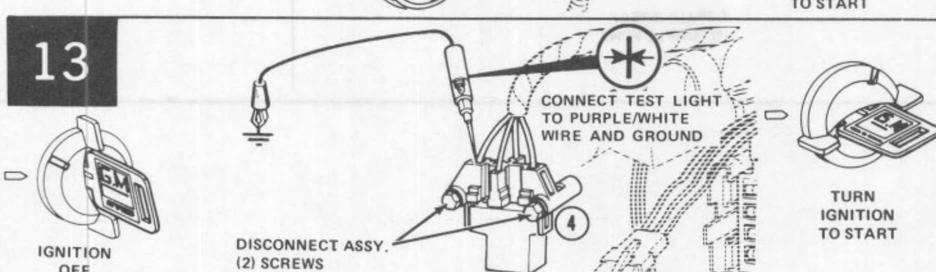
Work through each step of the diagnosis and trouble shooting charts till the system is repaired.
To find where parts are located in the system just look at the parts locator at the top of each chart.

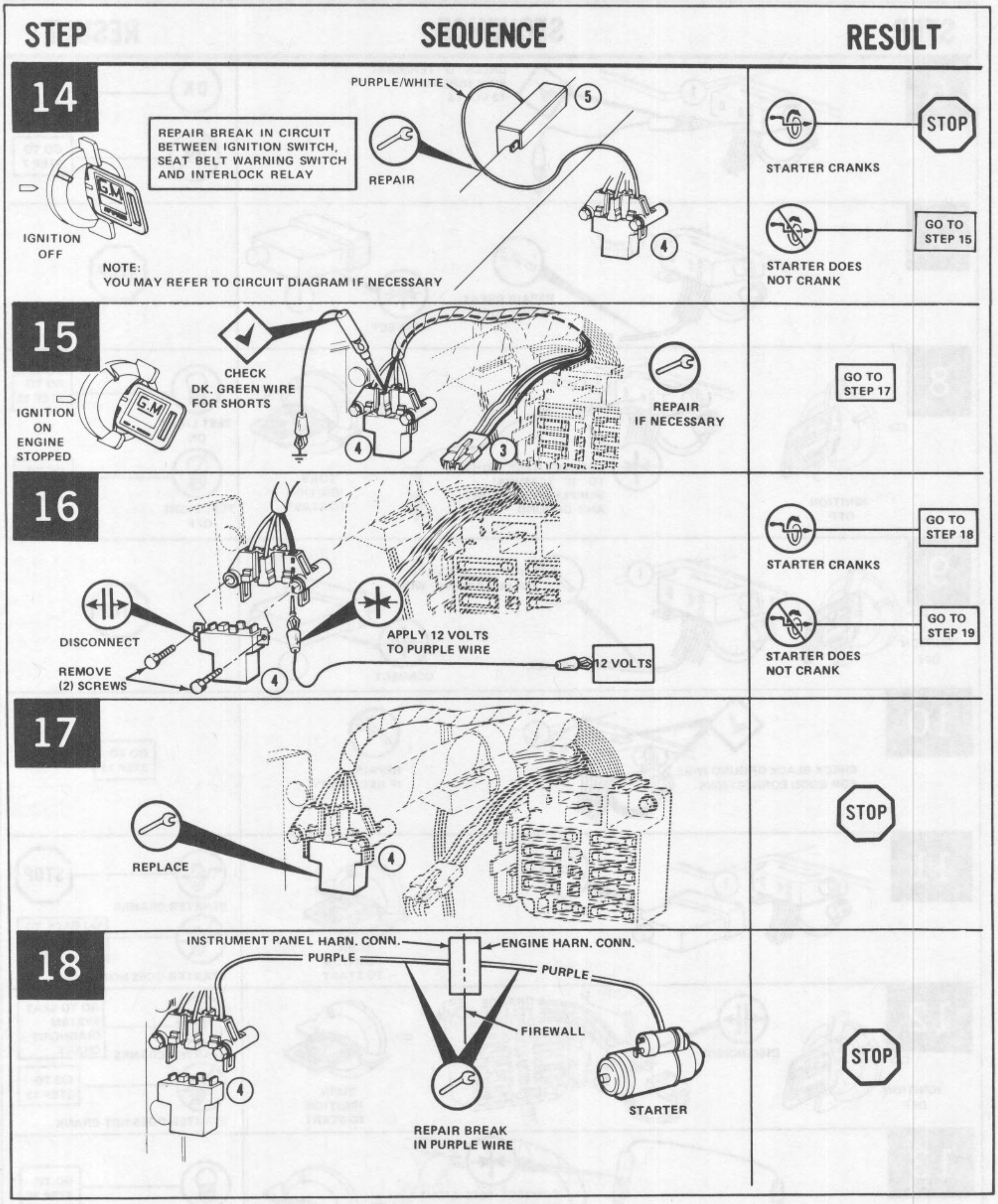
PROBLEM: starter WILL NOT CRANK

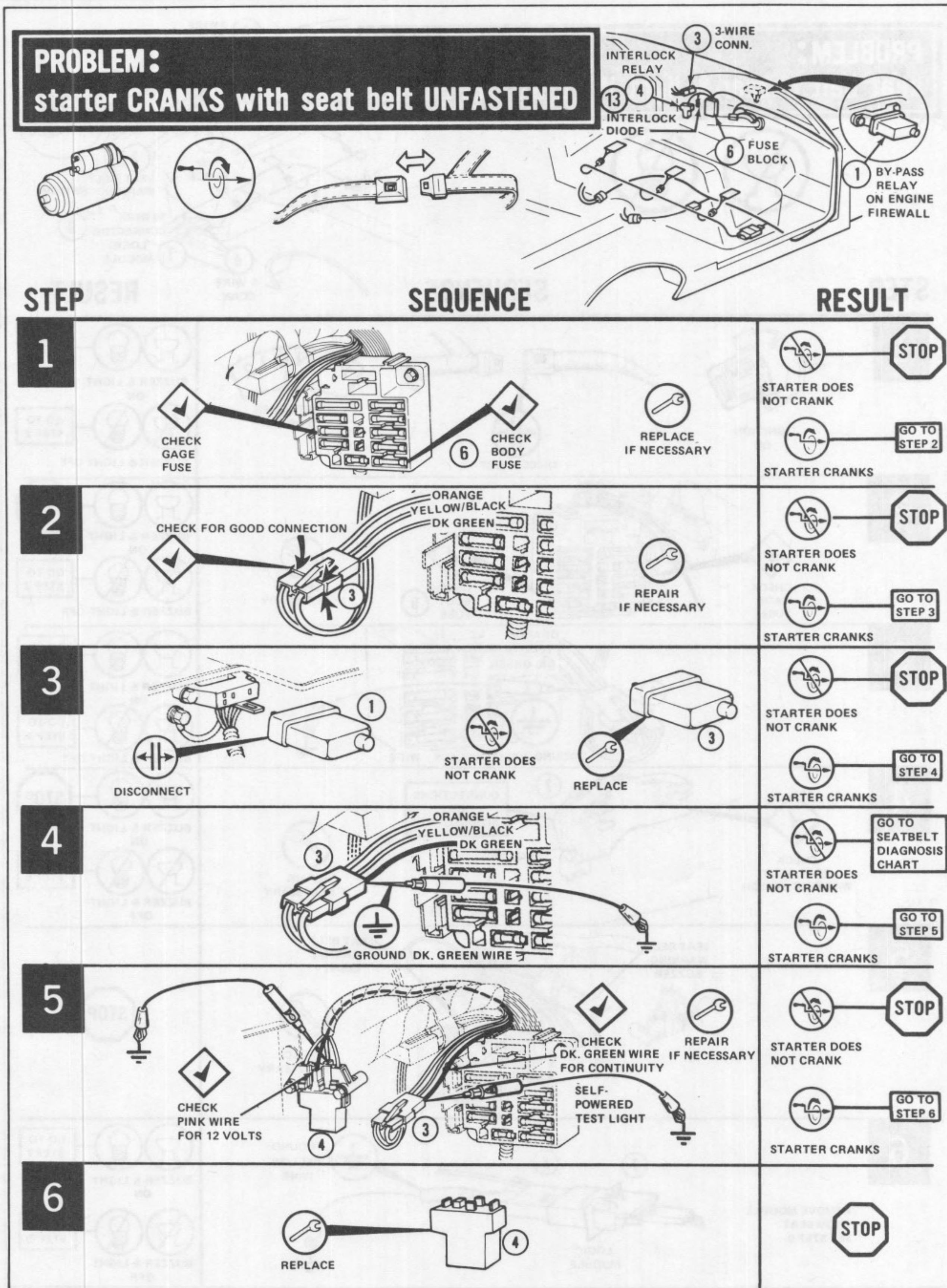


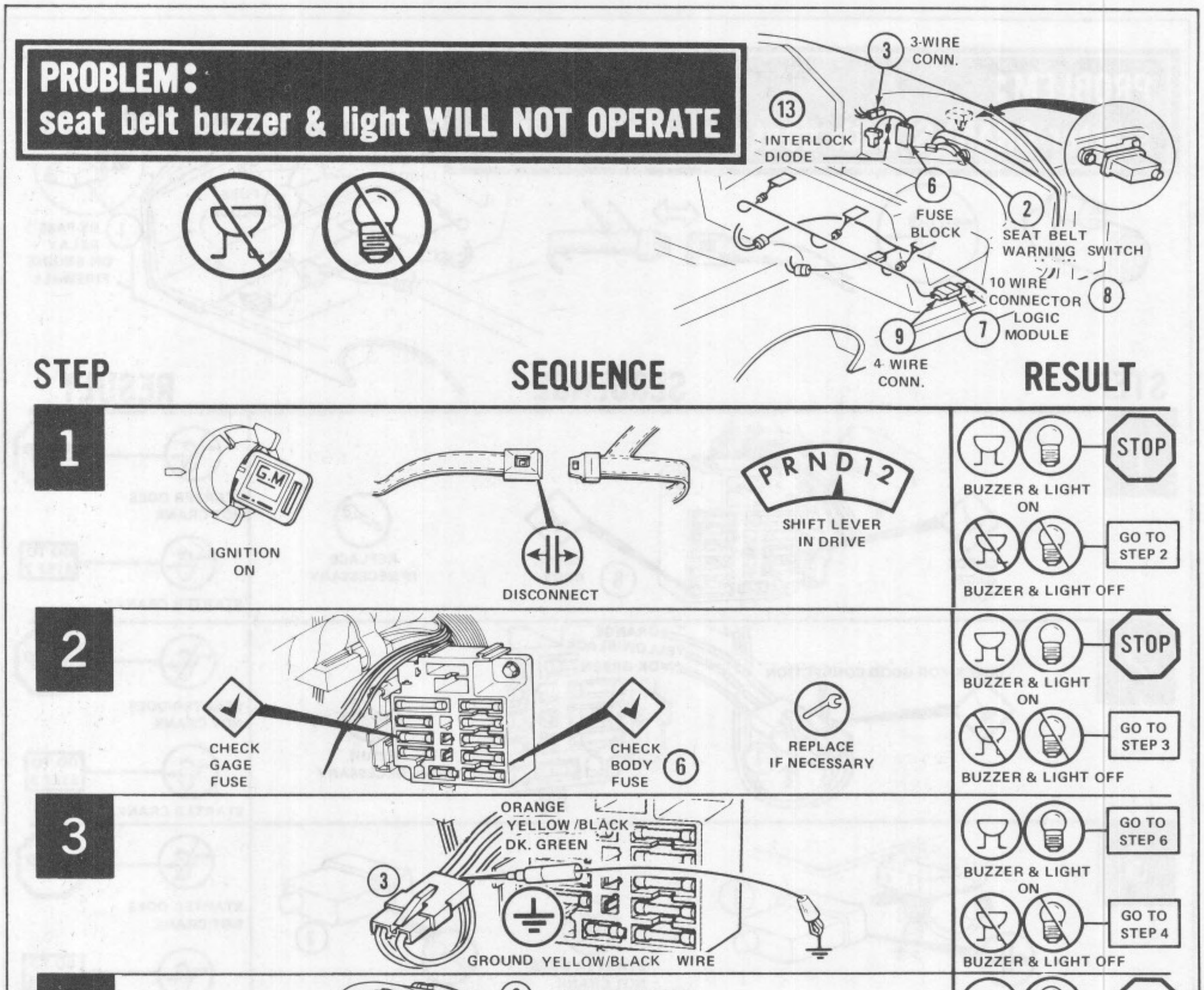
(USING CORRECT STARTING PROCEDURE)

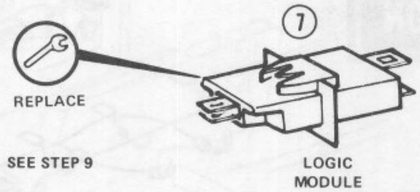
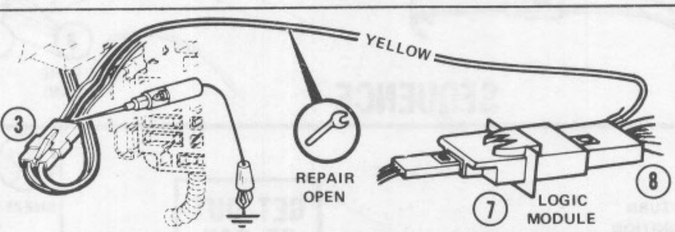
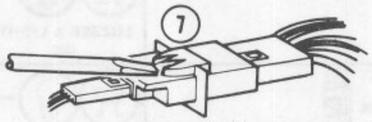
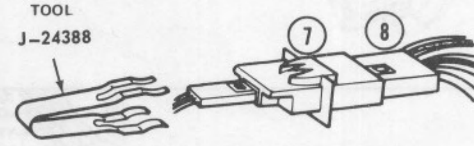
STEP	SEQUENCE	RESULT
1	IGNITION TO START CHECK FOR CLICK IN STARTER SOLENOID CLICK	DOES CLICK — GO TO STARTING CIRCUIT DIAGRAM DOES NOT CLICK — GO TO STEP 2
2	HONK HORN TO MAKE SURE BATTERY & CABLES ARE OK REPAIR OR REPLACE IF NECESSARY	GO TO STEP 3
3	IGNITION ON SHIFT LEVER IN PARK PRND12 1 PRESS & RELEASE IGNITION TO START (WHILE SEATED)	STARTER CRANKS — GO TO STEP 4 STARTER DOES NOT CRANK — GO TO STEP 5
4	IGNITION OFF FROM OUTSIDE OF CAR TURN IGNITION TO START, SEAT BELTS UNFASTENED	STARTER CRANKS — GO TO SEAT BELT SYSTEM DIAGNOSIS STARTER DOES NOT CRANK — GO TO STEP 12
5	IGNITION ON LEVER IN PARK PRND12 1 DISCONNECT	STARTER CRANKS — GO TO STEP 6
	1 APPLY 12 VOLTS TO "C" TERMINAL PURPLE WIRE 12 V	STARTER DOES NOT CRANK — GO TO STARTING CIRCUIT DIAGNOSIS IN SECTION 6

STEP	SEQUENCE	RESULT
6	 CHECK "D" TERMINAL PINK WIRE FOR 12 VOLTS	OK — GO TO STEP 8 NOT OK — GO TO STEP 7
7	 REPAIR BREAK IN PINK WIRE PINK CONNECT	STOP
8	 IGNITION OFF CONNECT TEST LIGHT TO "B" TERMINAL (PURPLE/WHITE WIRE) AND GROUND TURN IGNITION TO START	TEST LIGHT ON — GO TO STEP 10 TEST LIGHT OFF — GO TO STEP 9
9	 IGNITION OFF REPAIR BREAK IN PURPLE/WHITE WIRE GREEN/BLACK CONNECT	STOP
10	 CHECK BLACK GROUND WIRE FOR GOOD CONNECTIONS REPAIR IF NECESSARY	GO TO STEP 11
11	 REPLACE TURN IGNITION TO START	STARTER CRANKS — STOP STARTER DOES NOT CRANK — GO BACK TO STEP 3 AND START OVER
12	 IGNITION OFF DISCONNECT ORANGE YELLOW/BLACK DK GREEN TURN IGNITION TO START	STARTER CRANKS — GO TO SEAT SYSTEM DIAGNOSIS CHART STARTER DOES NOT CRANK — GO TO STEP 13
13	 IGNITION OFF CONNECT TEST LIGHT TO PURPLE/WHITE WIRE AND GROUND DISCONNECT ASSY. (2) SCREWS TURN IGNITION TO START	TEST LIGHT ON — GO TO STEP 16 TEST LIGHT OFF — GO TO STEP 14

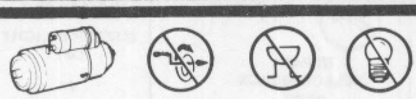

STEP
SEQUENCE
RESULT
14
PURPLE/WHITE
5
REPAIR BREAK IN CIRCUIT BETWEEN IGNITION SWITCH, SEAT BELT WARNING SWITCH AND INTERLOCK RELAY
REPAIR
4
IGNITION OFF
NOTE:
YOU MAY REFER TO CIRCUIT DIAGRAM IF NECESSARY
STARTER CRANKS
STOP
STARTER DOES NOT CRANK
GO TO STEP 15
15
CHECK DK. GREEN WIRE FOR SHORTS
IGNITION ON ENGINE STOPPED
4
3
REPAIR IF NECESSARY
GO TO STEP 17
16
DISCONNECT
REMOVE (2) SCREWS
4
APPLY 12 VOLTS TO PURPLE WIRE
12 VOLTS
STARTER CRANKS
GO TO STEP 18
STARTER DOES NOT CRANK
GO TO STEP 19
17
REPLACE
4
STOP
18
INSTRUMENT PANEL HARN. CONN.
ENGINE HARN. CONN.
PURPLE
PURPLE
FIREWALL
4
STARTER
REPAIR BREAK IN PURPLE WIRE
STOP

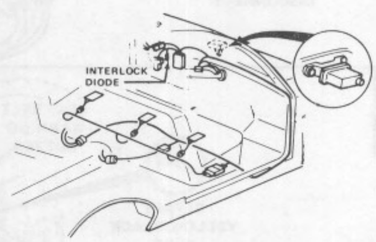

PROBLEM:
starter CRANKS with seat belt UNFASTENED
3 3-WIRE CONN.
INTERLOCK RELAY
13 4 INTERLOCK DIODE
6 FUSE BLOCK
1 BY-PASS RELAY ON ENGINE FIREWALL
STEP
SEQUENCE
RESULT
1
CHECK GAGE FUSE
6 CHECK BODY FUSE
REPLACE IF NECESSARY
STARTER DOES NOT CRANK
STOP
STARTER CRANKS
GO TO STEP 2
2
CHECK FOR GOOD CONNECTION
ORANGE
YELLOW/BLACK
DK GREEN
3
REPAIR IF NECESSARY
STARTER DOES NOT CRANK
STOP
STARTER CRANKS
GO TO STEP 3
3
1
DISCONNECT
STARTER DOES NOT CRANK
3
REPLACE
STARTER DOES NOT CRANK
STOP
STARTER CRANKS
GO TO STEP 4
4
ORANGE
YELLOW/BLACK
DK GREEN
3
GROUND DK. GREEN WIRE
STARTER DOES NOT CRANK
GO TO SEATBELT DIAGNOSIS CHART
STARTER CRANKS
GO TO STEP 5
5
CHECK PINK WIRE FOR 12 VOLTS
4
CHECK DK. GREEN WIRE FOR CONTINUITY
REPAIR IF NECESSARY
SELF-POWERED TEST LIGHT
3
STARTER DOES NOT CRANK
STOP
STARTER CRANKS
GO TO STEP 6
6
REPLACE
4
STOP

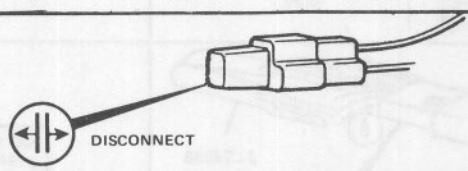
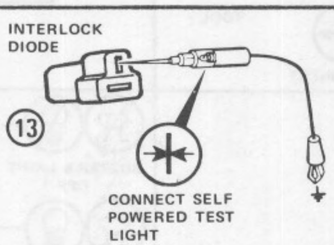
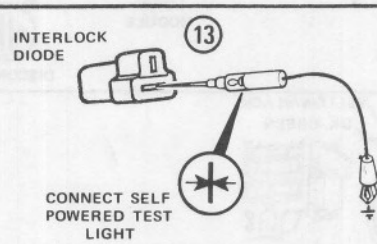
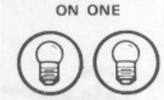
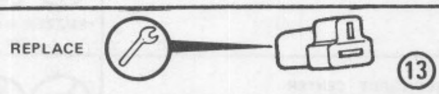
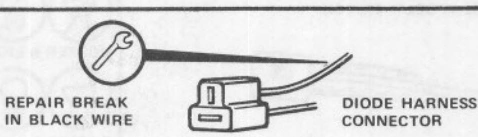

PROBLEM:
seat belt buzzer & light WILL NOT OPERATE
3 3-WIRE CONN.
13 INTERLOCK DIODE
6 FUSE BLOCK
2 SEAT BELT WARNING SWITCH
10 WIRE CONNECTOR
8
7 LOGIC MODULE
9 4-WIRE CONN.
STEP
SEQUENCE
RESULT
1
IGNITION ON
DISCONNECT
PRND12
SHIFT LEVER IN DRIVE
BUZZER & LIGHT ON
STOP
BUZZER & LIGHT OFF
GO TO STEP 2
2
CHECK GAGE FUSE
CHECK BODY FUSE 6
REPLACE IF NECESSARY
BUZZER & LIGHT ON
STOP
BUZZER & LIGHT OFF
GO TO STEP 3
3
ORANGE
YELLOW/BLACK
DK. GREEN
3
GROUND YELLOW/BLACK WIRE
BUZZER & LIGHT ON
GO TO STEP 6
BUZZER & LIGHT OFF
GO TO STEP 4
4
2
CONNECTIONS OR ADJUSTMENTS
CHECK SEAT BELT WARNING SWITCH
REPAIR IF NECESSARY
BUZZER & LIGHT ON
STOP
BUZZER & LIGHT OFF
GO TO STEP 5
5
SEAT BELT WARNING BUZZER
SEAT BELT WARNING LIGHT
CHECK BUZZER & LIGHT
REPLACE IF NECESSARY
STOP
6
7
8
GROUND YELLOW WIRE
REMOVE MODULE FROM SEAT SEE STEP 9
LOGIC MODULE
BUZZER & LIGHT ON
GO TO STEP 7
BUZZER & LIGHT OFF
GO TO STEP 8

STEP	SEQUENCE	RESULT
7		STOP
8		STOP
9	 	

PROBLEM: starter DOES NOT CRANK & seat belt light & buzzer DO NOT OPERATE



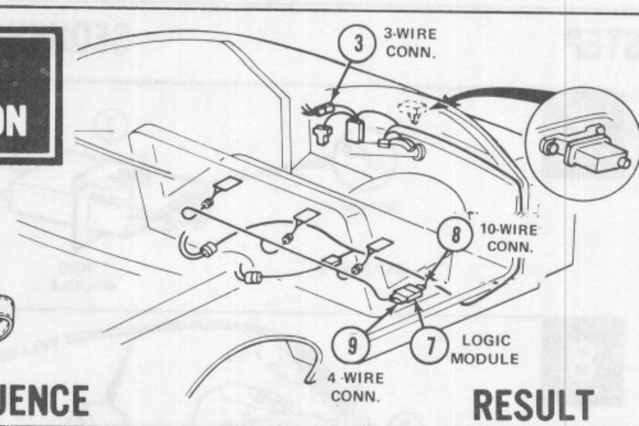


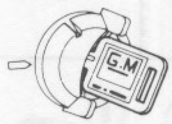
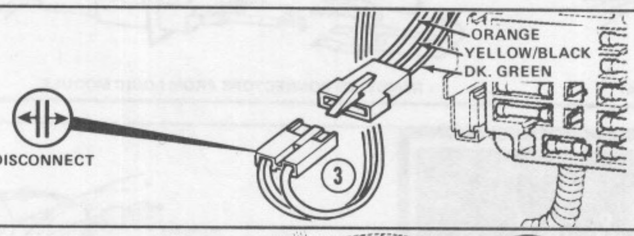
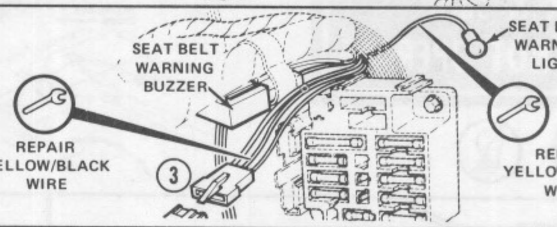
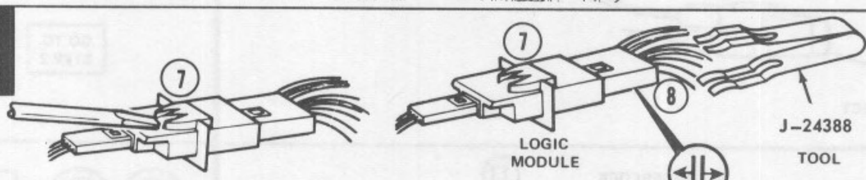
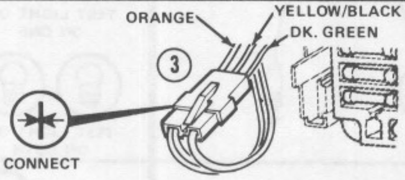
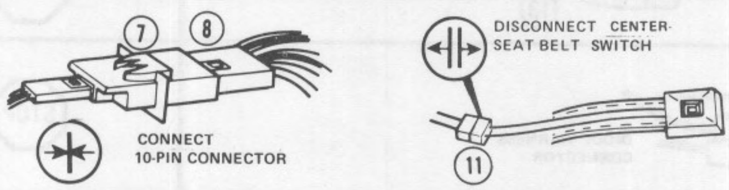
STEP	SEQUENCE	RESULT
1		GO TO STEP 2
2	 	 TEST LIGHT ON ON ONE — GO TO STEP 4  TEST LIGHT ON ON BOTH — GO TO STEP 3
3		STOP
4		STOP

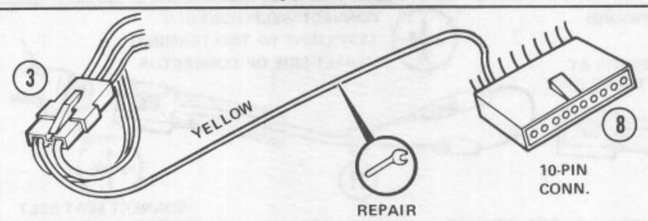
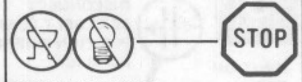
PROBLEM: seat belt buzzer & light REMAIN ON

(SEAT BELTS PROPERLY FASTENED)

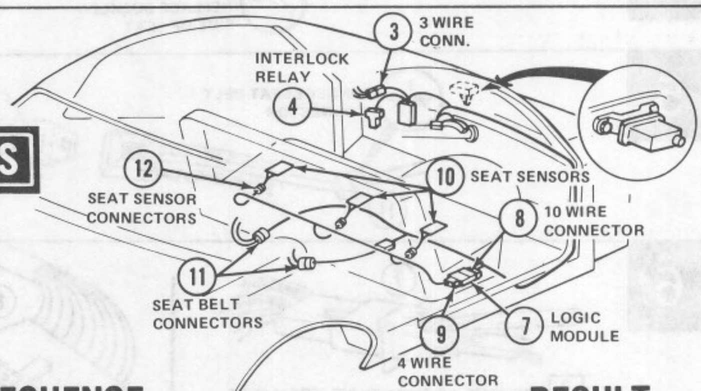
ENGINE STARTS NORMALLY

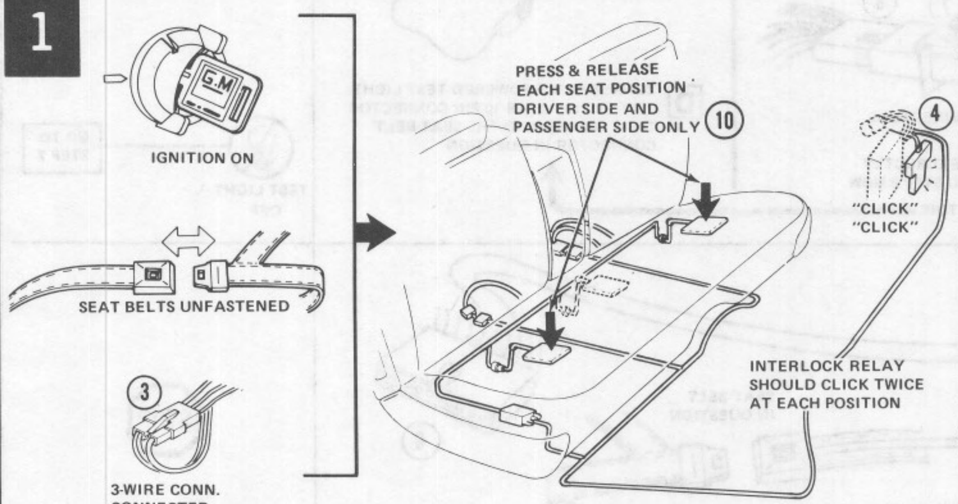
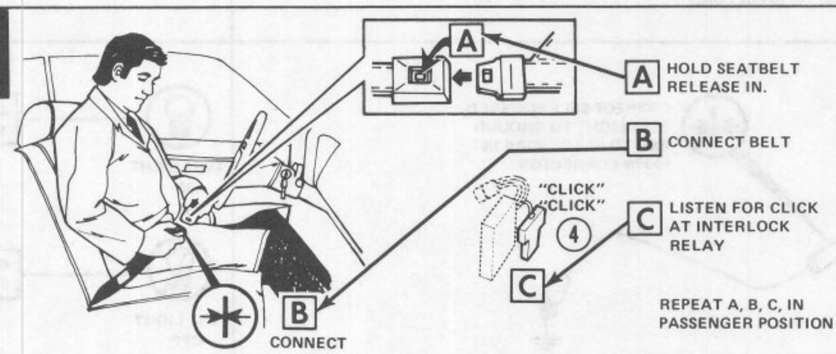


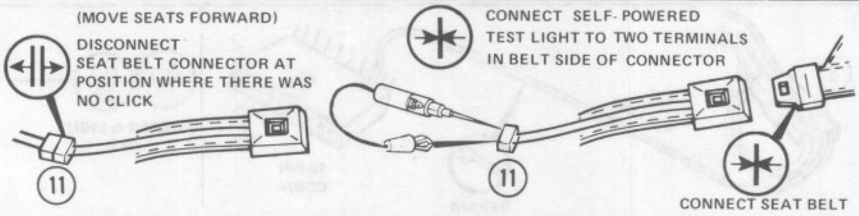
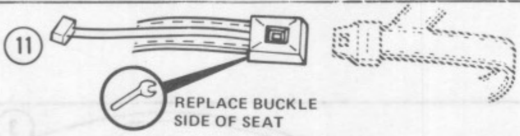
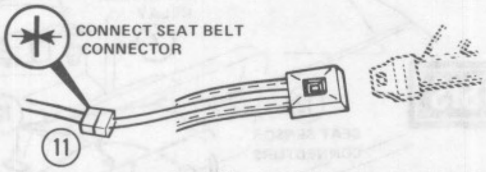
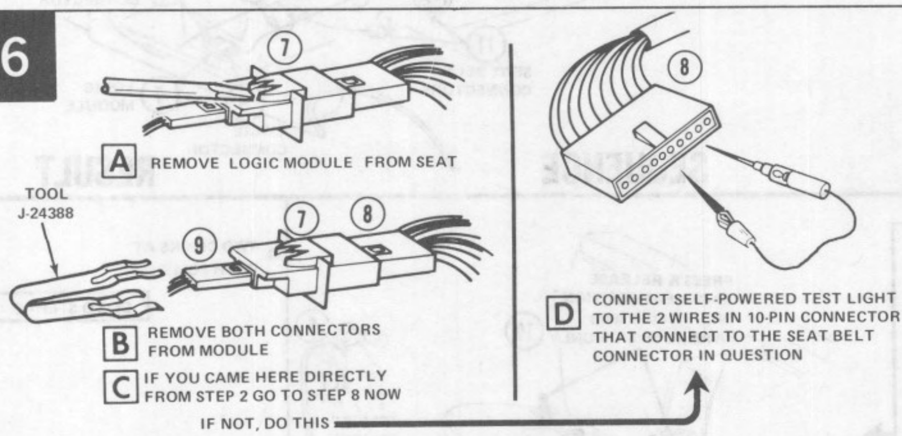
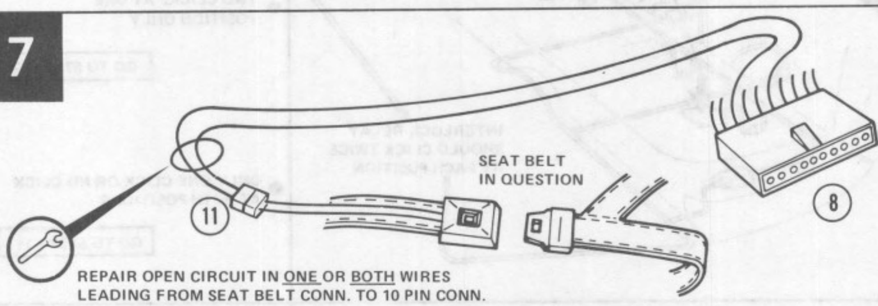
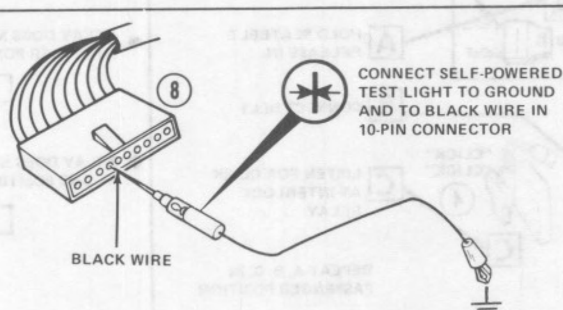
STEP	SEQUENCE	RESULT
1	 TURN IGNITION ON — GET OUT OF CAR	BUZZER & LIGHT OFF — GO TO SEAT BELT DIAGNOSIS CHART BUZZER & LIGHT ON — GO TO STEP 2
2	 DISCONNECT ③ (ORANGE, YELLOW/BLACK, DK. GREEN)	BUZZER & LIGHT ON — GO TO STEP 3 BUZZER & LIGHT OFF — GO TO STEP 4
3	 REPAIR YELLOW/BLACK WIRE (SEAT BELT WARNING BUZZER) ③; REPAIR YELLOW/BLACK WIRE (SEAT BELT WARNING LIGHT)	BUZZER & LIGHT OFF — STOP
4	 REMOVE LOGIC MODULE FROM SEAT ⑦; LOGIC MODULE ⑦ ⑧ DISCONNECT; J-24388 TOOL	GO TO STEP 5
5	 CONNECT ③ (ORANGE, YELLOW/BLACK, DK. GREEN)	BUZZER & LIGHT OFF — GO TO STEP 6 BUZZER & LIGHT ON — GO TO STEP 7
6	 CONNECT 10-PIN CONNECTOR ⑦ ⑧; DISCONNECT CENTER SEAT BELT SWITCH ⑪	BUZZER & LIGHT OFF — REPLACE SEAT SWITCH BUZZER & LIGHT ON — REPLACE LOGIC MODULE

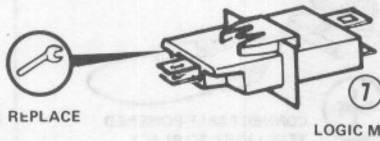
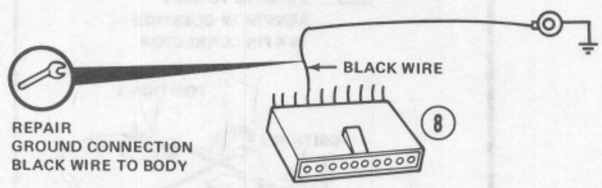
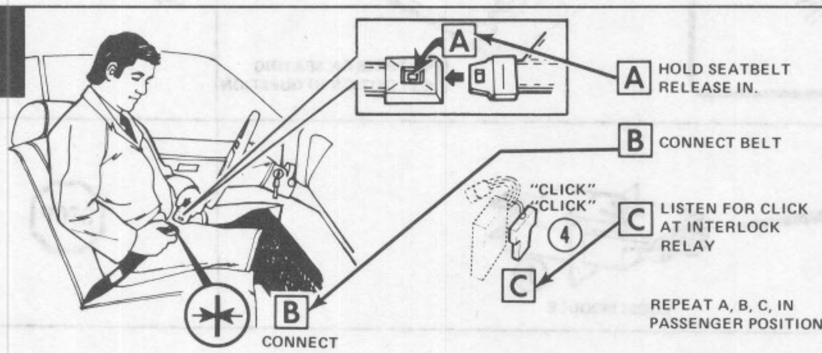
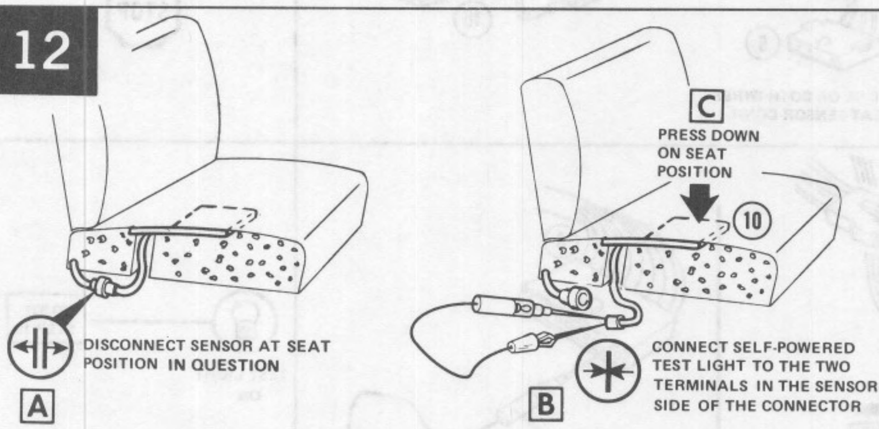
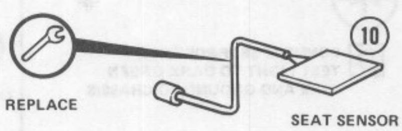
STEP	SEQUENCE	RESULT
7		 BUZZER & LIGHT OFF

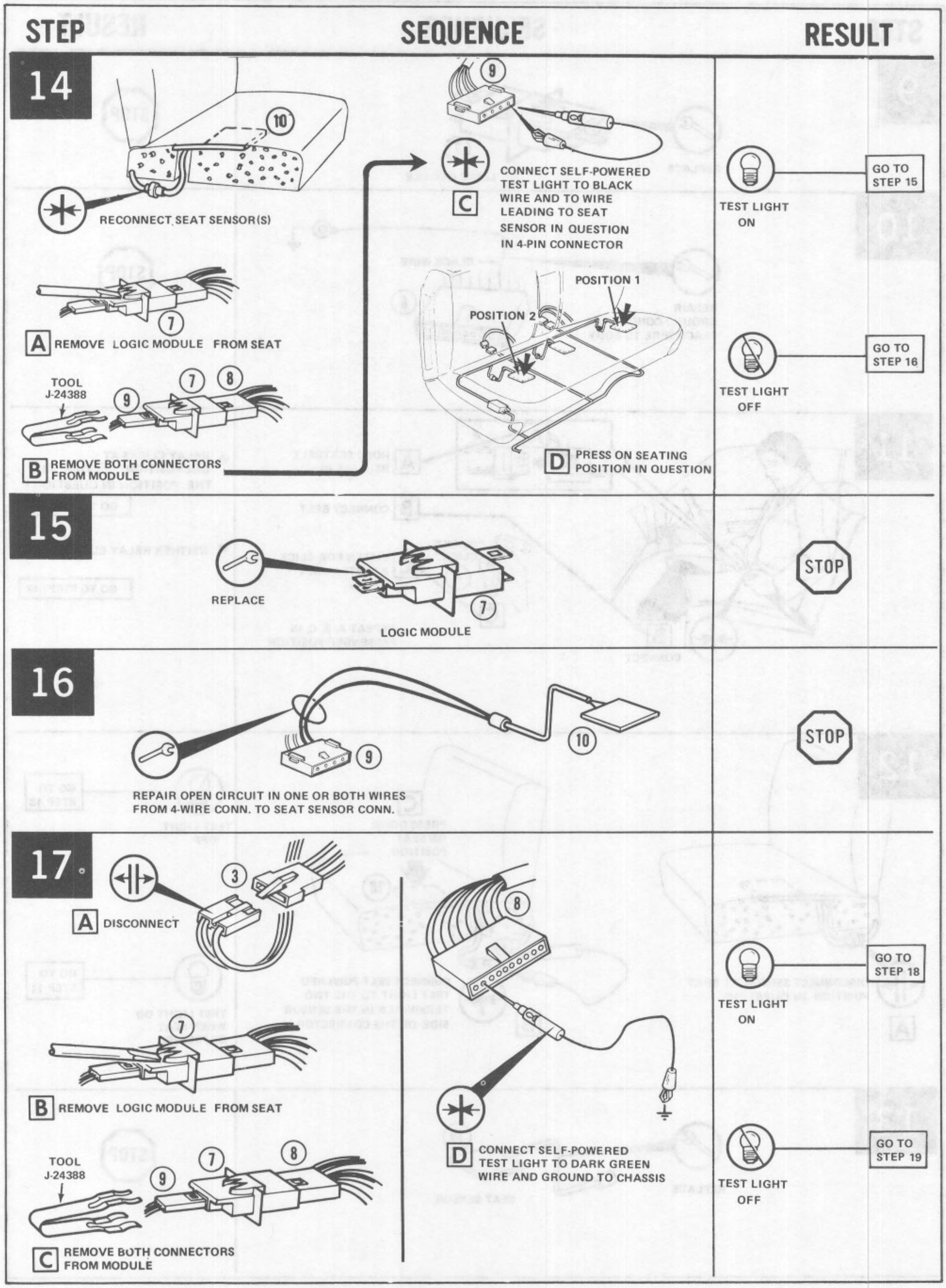
SEAT BELT SYSTEM DIAGNOSIS

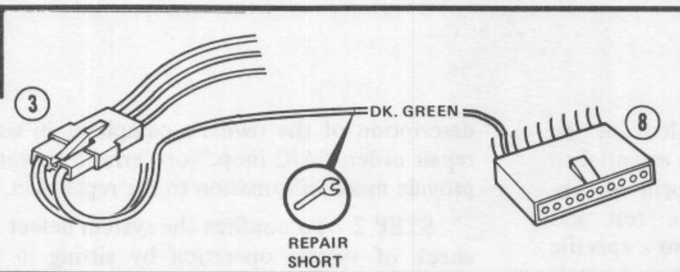
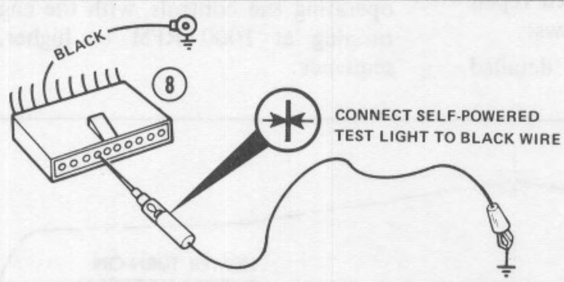
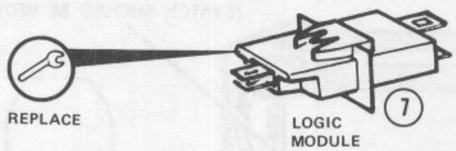
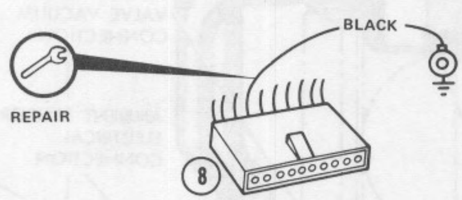


STEP	SEQUENCE	RESULT
1		• TWO CLICKS AT BOTH POSITIONS GO TO STEP - 2 • TWO CLICKS AT ONE POSITION ONLY GO TO STEP - 12 • ONLY ONE CLICK OR NO CLICK AT BOTH POSITIONS GO TO STEP - 11
2	 REPEAT A, B, C, IN PASSENGER POSITION	• RELAY DOES NOT CLICK AT EITHER POSITION GO TO STEP - 6 • RELAY DOES NOT CLICK AT ONE POSITION GO TO STEP - 3

STEP	SEQUENCE	RESULT
3 IGNITION OFF	(MOVE SEATS FORWARD) DISCONNECT SEAT BELT CONNECTOR AT POSITION WHERE THERE WAS NO CLICK CONNECT SELF-POWERED TEST LIGHT TO TWO TERMINALS IN BELT SIDE OF CONNECTOR CONNECT SEAT BELT  	TEST LIGHT OFF — GO TO STEP 4 TEST LIGHT ON WHEN BUCKLED — GO TO STEP 5
4	REPLACE BUCKLE SIDE OF SEAT  	STOP
5	CONNECT SEAT BELT CONNECTOR  	GO TO STEP 6
6	A REMOVE LOGIC MODULE FROM SEAT TOOL J-24388 B REMOVE BOTH CONNECTORS FROM MODULE C IF YOU CAME HERE DIRECTLY FROM STEP 2 GO TO STEP 8 NOW IF NOT, DO THIS D CONNECT SELF-POWERED TEST LIGHT TO THE 2 WIRES IN 10-PIN CONNECTOR THAT CONNECT TO THE SEAT BELT CONNECTOR IN QUESTION  	TEST LIGHT ON — GO TO STEP 8 TEST LIGHT OFF — GO TO STEP 7
7	SEAT BELT IN QUESTION REPAIR OPEN CIRCUIT IN <u>ONE</u> OR <u>BOTH</u> WIRES LEADING FROM SEAT BELT CONN. TO 10 PIN CONN.  	STOP
8	CONNECT SELF-POWERED TEST LIGHT TO GROUND AND TO BLACK WIRE IN 10-PIN CONNECTOR BLACK WIRE  	TEST LIGHT ON — GO TO STEP 9 TEST LIGHT OFF — GO TO STEP 10

STEP	SEQUENCE	RESULT
9		STOP
10		STOP
11		• RELAY CLICKS AT ONE POSITION (THIS IS THE POSITION IN QUESTION) GO TO STEP - 12 • NEITHER RELAY CLICKS GO TO STEP - 17
12		TEST LIGHT OFF — GO TO STEP 13 TEST LIGHT ON WHEN SEAT DEPRESSED — GO TO STEP 14
13		STOP


STEP
SEQUENCE
RESULT
14
10
RECONNECT SEAT SENSOR(S)
7
A REMOVE LOGIC MODULE FROM SEAT
TOOL
J-24388
9
7
8
B REMOVE BOTH CONNECTORS FROM MODULE
9
C CONNECT SELF-POWERED TEST LIGHT TO BLACK WIRE AND TO WIRE LEADING TO SEAT SENSOR IN QUESTION IN 4-PIN CONNECTOR
POSITION 1
POSITION 2
D PRESS ON SEATING POSITION IN QUESTION
TEST LIGHT ON
GO TO STEP 15
TEST LIGHT OFF
GO TO STEP 16
15
REPLACE
7
LOGIC MODULE
STOP
16
10
9
REPAIR OPEN CIRCUIT IN ONE OR BOTH WIRES FROM 4-WIRE CONN. TO SEAT SENSOR CONN.
STOP
17
A DISCONNECT
3
7
B REMOVE LOGIC MODULE FROM SEAT
TOOL
J-24388
9
7
8
C REMOVE BOTH CONNECTORS FROM MODULE
8
D CONNECT SELF-POWERED TEST LIGHT TO DARK GREEN WIRE AND GROUND TO CHASSIS
TEST LIGHT ON
GO TO STEP 18
TEST LIGHT OFF
GO TO STEP 19

STEP	SEQUENCE	RESULT
18		STOP
19		TEST LIGHT ON — GO TO STEP 20 TEST LIGHT OFF — GO TO STEP 21
20		STOP
21		STOP

DIAGNOSIS OF PROBLEMS—FRONT A/C—ALL SERIES

1. How to Isolate the Problem

To diagnose an air conditioner problem in the shortest time and with the least effort, it is essential to follow a logical service procedure. Time spent in conducting a system functional performance test and analyzing the defect in order to isolate it to a specific control function area will be repaid in reduced repair time. A recommended diagnosis procedure follows:

STEP 1 - Attempt to get an accurate, detailed description of the owner's complaint in writing on the repair order. "A/C inop." or "erratic operation" do not provide much information to the repairman.

STEP 2 - To confirm the system defect make a brief check of system operation by sitting in the car and operating the controls, with the engine warmed up and running at 1000 RPM or higher, in the following sequence:

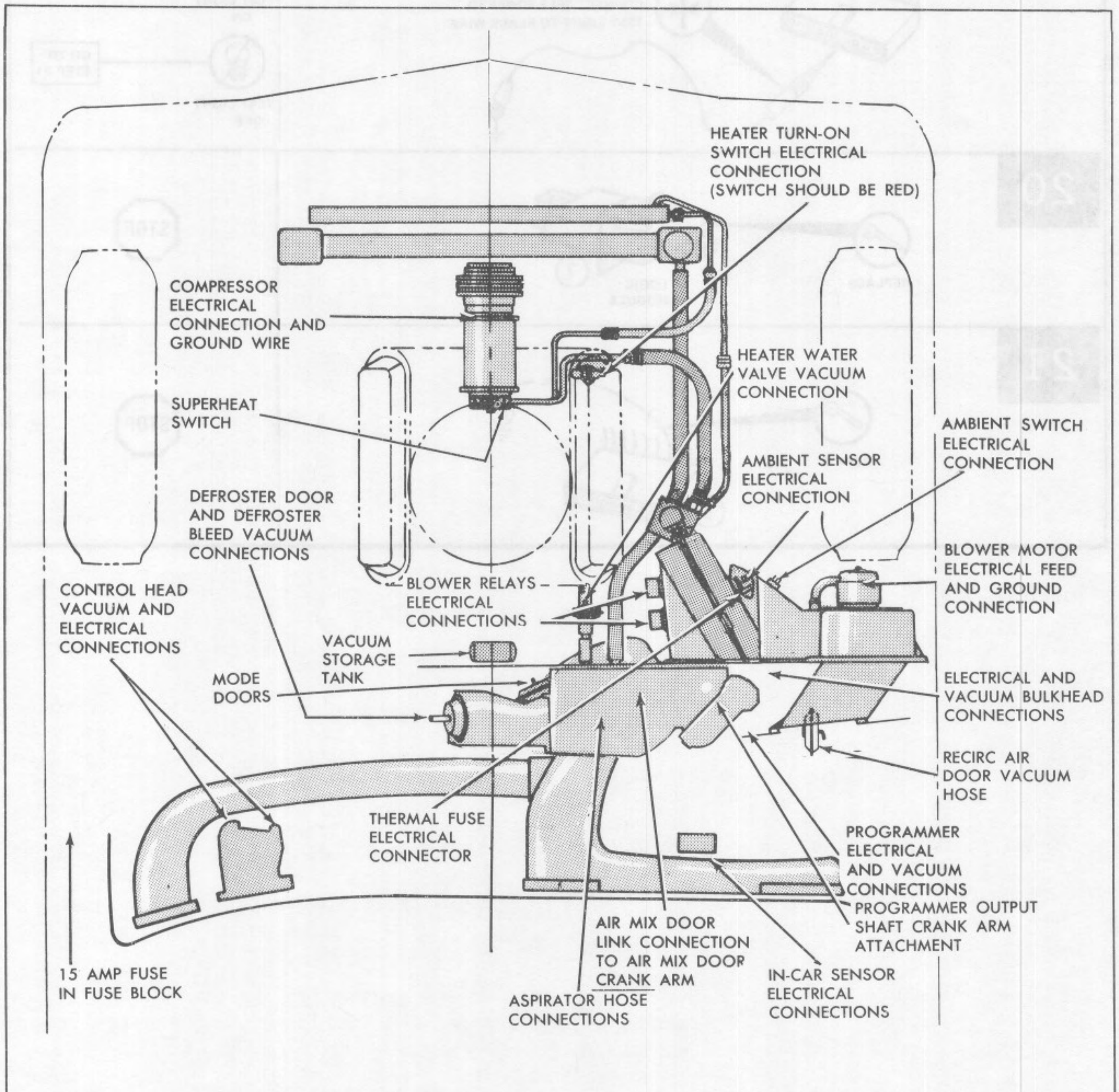


Fig. 1-2 A/C Diagnosis Areas

AUTOMATIC TEMPERATURE CONTROL FUNCTIONAL TEST	
CONTROL SETTING	SYSTEM SHOULD OPERATE AS FOLLOWS:
"DEF" DIAL @ 85	Air should be delivered out of defroster outlets at a fixed high blower speed. Some floor bleed out heater.
"BI-LEVEL" DIAL @ 75°	Air should be delivered from both the A/C and heater outlets at a reduced blower speed. Only a small portion of air will come out the defroster outlet.
"HI" DIAL @ 65°	Air should be delivered out the A/C outlets at a fixed high blower speed and cool to cold temperature. The recirculating air door should open(blower noise increases). Door movement will be slow because of vacuum delay plug.
"AUTO" DIAL @ 85°	Blower speeds should drop (Hi - M_3 - M_2 - M_1 - etc.). Recirc air door should close (noise level will drop). Discharge air temperature should increase. Depending on the temperature in the work area, the air delivery mode should change from the A/C outlets to the heater outlets.
"LO" DIAL @ 85°	Air should be delivered at a fixed low blower speed.
"VENT" DIAL @ 65°	Air should be discharged from the A/C outlets at a fixed low blower speed. The A/C compressor should not operate.
"OFF" DIAL @ 65°	Air should be discharged out the heater outlet at a fixed low blower speed. No A/C compressor operation.

During the above tests, be sure to note the following:

a. Check to assure that air delivery is not coming from both the A/C and heater outlets when only one mode is indicated. A split air delivery is indicative of a vacuum leak.

b. Note whether program events (air delivery mode change, blower speed change, recirc air, etc.) occur without change in discharge air temperature. This would indicate the programmer is operating without moving the temperature air door. Check the air mix door link to programmer connection.

c. If neither the program events nor the discharge air temperature change, a faulty vacuum or electrical signal to the programmer or a programmer malfunction is indicated.

d. Failure of a specific vacuum operated door function could indicate a vacuum disconnect of the vacuum diaphragm at that door. See illustrations for locations of the different function doors.

STEP 3 - Perform the easiest checks first! A simple, visual inspection of the easily accessible underhood and instrument panel electrical and vacuum connections will, in many instances, reveal the defect on the spot. The areas indicated in Fig. 1-2 can be inspected without removing any car parts: It may be necessary to remove lower instrument panel cover to inspect control head.

STEP 4 - Based on information gained during the functional test performed in step 2, try to relate the problem to one of the following areas:

1. Temperature Control Problems
2. Blower Control Problems
3. Auxiliary Vacuum Problems
4. Refrigeration System Problems

Once a problem has been isolated to one of the areas listed above, refer to that diagnosis section on the following pages. Diagnosis charts and control circuit illustrations are provided. It is of special importance to be familiar with the general description of the major sections of the system as presented in the Theory of Operation section beginning on page 1-29.

STEP 5 - After the problem has been properly diagnosed and the repair made, it is important to run through the brief check listed in Step 2 in order to assure that the system is now performing correctly.

2. Temperature Control Problem Diagnosis

The primary function of the temperature control circuit is to determine the correct temperature of the air to be discharged into the passenger compartment and to set the air mix door position to accomplish that function. The signal used for this purpose (vacuum to position the programmer vacuum motor) is also used in the blower speed control circuit, and the auxiliary vacuum function circuit. Those uses may be disregarded when dealing with problems which relate only to the temperature control circuit.

Examples of temperature control problems are: "System operates at maximum air conditioning (no heat) or only at maximum heating (no air conditioning)", "Temperature dial does not provide comfort", "Poor heating or poor cooling". Blower cycling and mode cycling are also caused by a malfunction in the temperature control circuit.

It is important to separate temperature control circuit problems from refrigeration or heater circuit problems. If the complaint is "poor" or "no" heating or cooling and the programmer moves to both extremes of travel with the air mix door and program functions known to follow, the problem probably lies in the refrigerant or heater water circuits. Refer to that section on page 1-25.

Many temperature control problems result from poor electrical or vacuum line connections. The following relationships may aid diagnosis:

- A disconnected sensor or temperature dial interrupts the electrical signal and drives the programmer to maximum heating.
- A poor sensor connection adds resistance to the sensor string driving the system hotter.
- An open amplifier power feed eliminates the output signal and drives the programmer to maximum heating.

• A disconnected transducer lead drives the programmer to maximum heating.

• A disconnected vacuum hose supplying the vacuum checking relay actuating nipple will lock the relay in an intermediate position.

• A disconnected vacuum hose in the transducer - programmer vacuum motor line will drive the system to maximum cooling.

• A leak in the auxiliary vacuum circuit may reduce the transducer vacuum supply level below control requirements, causing an "off-calibration" or "poor heating" type of complaint.

• A loss of supply vacuum usually results in cold air flow on the floor.

Diagnosis of most of the problems encountered in the temperature control circuit will be greatly aided by use of tester, J-23678 (use Harness Adapter J-24774 to connect to programmer and harness). Information on how to use the A.T.C. Tester is provided on the tester cover.

Specific problems and probable causes are as follows:

SYSTEM OPERATES ONLY AT MAXIMUM AIR CONDITIONING

This can be a vacuum or electrical problem. The problem can be separated into problems of erroneous signal external to the programmer or internal programmer malfunctions. With the system operating, disconnect the ambient sensor electrical connector, and observe the programmer movement through the slot at the bottom of the programmer cover. If the programmer remains in the maximum air conditioner position, remove the multiple vacuum connector and check for supply vacuum at the black hose. If no (or low) vacuum supply, check for leaks or disconnects in vacuum hose assembly. If vacuum supply is okay, programmer is malfunctioning. Remove programmer cover and inspect for obvious disconnects. If no programmer defect is obvious, use Tester J-23678 and Adapter Harness J-24774 to analyze and correct problem.

If the programmer moved to the maximum heater position when the electrical connector was removed, the defect is external to the programmer. Check the following items:

1. Shorted in-car sensor or ambient sensor.
2. Shorted or miscalibrated temperature dial.
3. A short in the sensor circuit of the wiring harness.

SYSTEM OPERATES ONLY AT MAXIMUM HEATING

This is usually an electrical problem either internal or external to the programmer. Investigate the following areas:

1. Disconnected or defective in-car sensor.
2. Disconnected or defective ambient sensor.
3. Open circuit or backed-out terminal in the wiring harness sensor string circuit.
4. Disconnected or back-out terminal in the 3-way connector located under the instrument panel on the R.H. side of car near the programmer.
5. Disconnected or defective temperature dial.
6. Disconnect or open in ground circuit (black wire) between control head and programmer.
7. No electrical power to programmer (yellow wire).
8. No ground at amplifier.
9. Defect within programmer assembly.

Use Tester, J-23678 and Adapter Harness J-24774, to analyze and correct the above problems.

SYSTEM FLUCTUATES BLOWER SPEEDS and/or MODE SHIFTS DURING ACCELERATION

1. Defective vacuum checking relay (inside programmer).
2. Leaking programmer vacuum motor.

It is possible to distinguish between the two above items. With the system operating and the programmer cover removed, reinstall the vacuum and electrical connectors, and perform the following steps:

a. Remove the programmer electrical connector to force the programmer to maximum heating (full vacuum).

b. Remove the vacuum hose assembly connector. The programmer should remain in the maximum heat position. If it does not, repeat Step a, and then pinch the programmer vacuum motor supply hose with a pair of needle-nose pliers. If the programmer still moves, the vacuum motor is leaking. If the programmer does not move, the checking relay is defective.

c. If the original complaint was mode shifts without blower change, the check valve portion of the checking relay is probably defective.

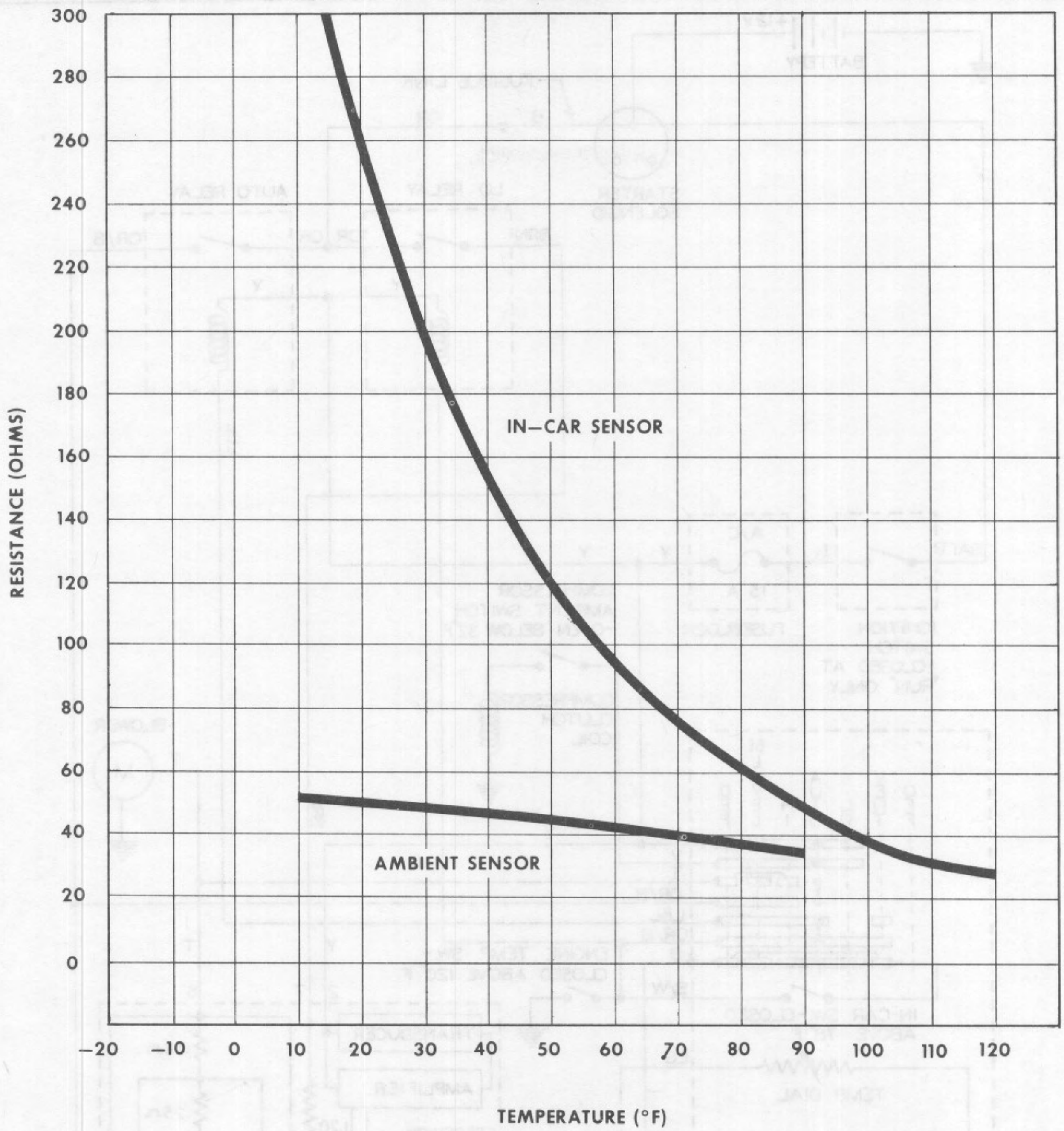


Fig. 1-3 Resistance Graph of Sensors

DIAL SETTING DOES NOT PROVIDE COMFORT

The best approach to solving problems of the "off calibration" variety, is to use Tester, J-23678 and Adapter Harness J-24774 to check and reset calibration on all of the following parts (see Note 53):

1. The temperature dial.
2. The feedback potentiometer in the programmer.
3. The temperature door link adjustment.
4. The sensor string.

(NOTE: Check to assure that in-car sensor aspirator hose is attached at both the in-car sensor and the aspirator and not kinked in routing.)

Refer to the instruction sheet included with the Tester or the section on System Adjustments for procedures on checking and calibrating the above items.

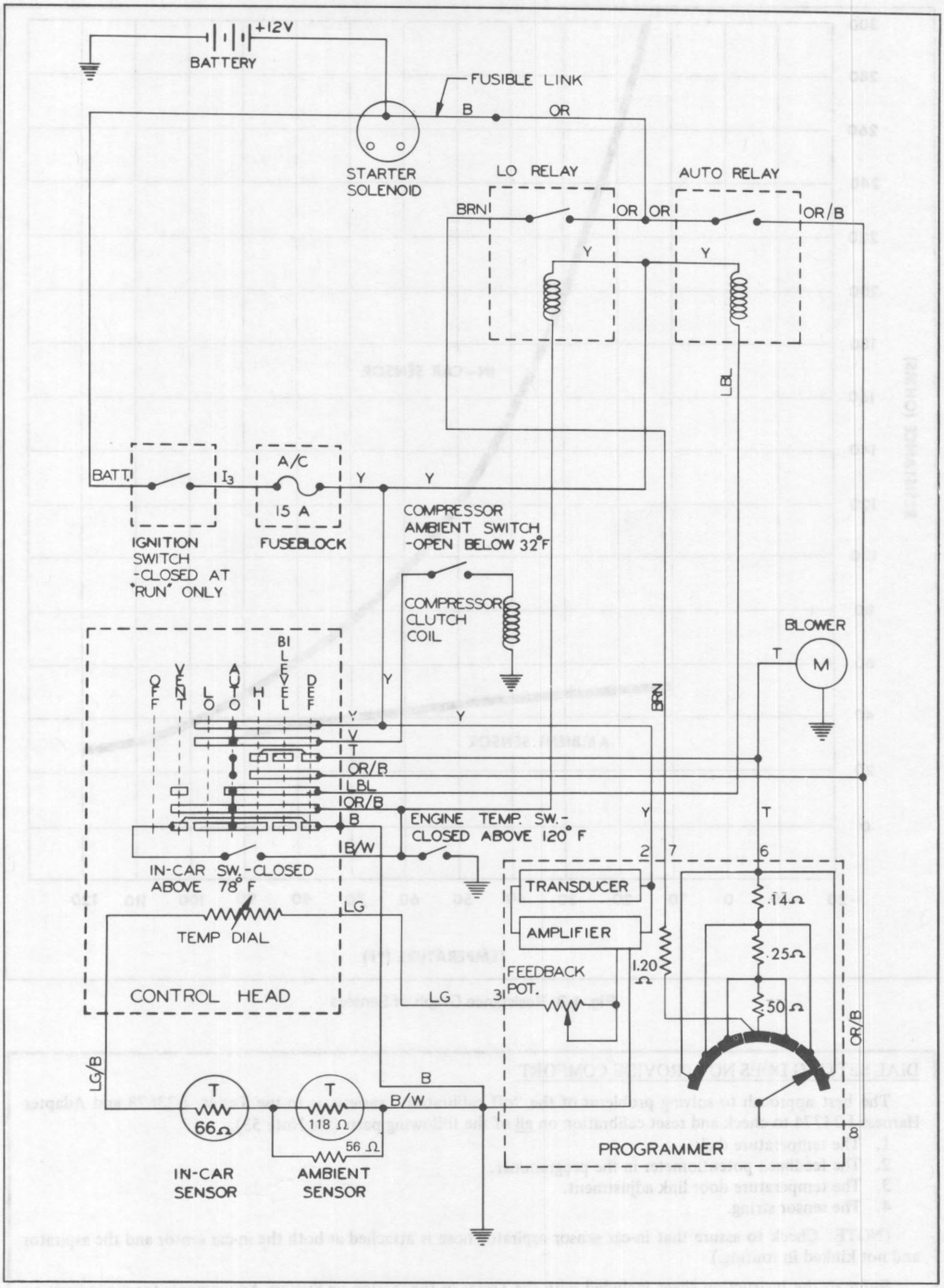


Fig. 1-4 Blower Control Circuit

BLOWER CYCLING AND MODE CYCLING

Erratic system performance may be caused by poor electrical connections, "cold" solder joints, or a defective sensor or amplifier. The problem may be intermittent and occur from the shock of going over road bumps. Such a problem may be accompanied by a clicking or buzzing of the transducer. To isolate the problem area, "rap" the areas around the sensors, control head, and programmer, and shake the wires attached to those areas. Listen for buzzing or clicking of the transducer. If the problem cannot be pinpointed by transducer buzzing, remove the programmer cover, (reinstall the vacuum and electrical connectors) and attach a good voltmeter to the transducer output terminal (grey wire). Repeat the rapping and wire shaking, and observe the voltmeter for violent, erratic voltage fluctuations. Replacement of parts or resoldering of terminals may be necessary. The sensors may be individually checked to the sensor resistance curve, Fig. 1-3.

(NOTE: Some system cycling may also occur and is normal if the temperature dial is moved in large increments. Instruct owner of this, and explain system operation.)

INSUFFICIENT HEATING OR COOLING

This problem may be caused by a control system malfunction or by the refrigerant or heater systems. Determine first which area to pursue:

1. Check for compressor clutch actuation (no cooling). If not operating, refer to Note 6 for diagnosis of low refrigerant detection system.
2. Check for clear sight glass and cold suction line (no cooling).
3. Check engine coolant level (no heating).
4. Check temperature of heater hoses by feel with engine hot to see if hot water is entering the heater core (no heating).
5. Check for proper air flow at the "Auto" and "Hi" lever settings. (Improper air flow may be a blower relay problem, a blocked air passage, or a disconnected air hose.)

If a refrigeration problem exists, refer to the refrigeration diagnosis section on page 1-25. If the problem appears to be caused by the temperature control system, locate problem area using Tester, J-23678 and Adapter Harness J-24774 or as specified elsewhere in this section. Also check air mix door link adjustments.

BLOWER SPEEDS AND MODE SHIFT OCCURS WITHOUT TEMPERATURE CHANGE

Check connection of air mix door link to programmer shaft and to air door crankarm.

3. Blower Control Circuit Problem Diagnosis

The components and electrical circuits that make up the blower control circuit are shown in Fig. 1-4. Blower control can be divided into two separate categories, blower turn-on and blower speed control. Blower turn-on is accomplished when a ground path is completed for either the "Lo" relay coil or the "Auto" relay coil. Relay coil grounds are completed by (a) the heater turn-on switch which provides delay for heater water warm-up in winter operation, (b) the in-car switch which provides immediate turn-on in summer operation, or (c) manual override in the "Vent" and "Def" settings. Blower speed control is accomplished by actuating only the low blower relay in the "Off", "Vent", and "Lo" positions, by selective use of the resistors on the blower circuit board in the "Auto" and "Bi-Level" lever settings, or by a high blower override circuit in the "Hi" and "Def" lever positions. It should be noted that the system air doors are always positioned to allow delivery of air into the passenger compartment. Problem descriptions and probable causes are listed in the following diagnosis chart:

SYSTEM OPERATES ONLY AT LOW BLOWER

1. Electrical disconnect at "Auto" blower relay.
2. Failed "Auto" blower relay.
3. Backed-out terminal or poor connection at six-way connector (located near programmer), at programmer, or at control head. Trace "Auto" blower circuit using electrical wiring diagram, Fig. 1-4.
4. Open in "Auto" blower circuit wiring.

Refer to wiring diagram, Fig. 1-4.

NO BLOWER OPERATION IN ANY LEVER SETTING

1. Electrical disconnect at blower motor or at radio capacitor in series with blower feed.
2. Blown or defective 15 amp. A/C-heater fuse.
3. Stalled blower motor.
4. Open circuit in wiring harness to blower motor.
5. Disconnect at six-way connector (near programmer).

NO BLOWER IN OFF, VENT OR LO SETTINGS

1. Disconnect at "Low" blower relay.
2. Failed "Lo" blower relay.
3. Open low speed resistor on programmer.
4. Backed-out terminal or poor connection at six-way connector (located near programmer) or at programmer. Trace lower blower circuit using electrical wiring diagram, Fig. 1-4.
5. Open in low blower circuit wiring. Refer to wiring diagram, Fig. 1-29.

OPERATES AT LOW BLOWER ONLY EXCEPT IN "HI" AND "DEF"

1. Defect in programmer wiper contacts or board.
2. Backed-out terminal or disconnect at programmer electrical connector.
3. Open in programmer internal wiring.

BLOWER OPERATION ONLY IN "HI" OR "DEF"

1. Electrical disconnect at programmer (system will also operate only at maximum heat).

BLOWER SPEED VARIES IN "HI" AND "DEF"

1. Defective wipers or board in control head circuit board switch.
2. Open in control head wiring harness.
3. Open in by-pass circuit in wiring harness (refer to electrical circuit diagram, Fig. 1-29).

BLOWER OPERATES WITH IGNITION OFF

1. Defective blower relay (closed contacts).

BLOWER SPEEDS SKIPPED IN "AUTO" SETTING

1. Open resistor on programmer blower circuit board.

NO HEATER TURN-ON IN COLD WEATHER EXCEPT IN "VENT" AND "DEF"

1. Electrical disconnect at heater turn-on switch (located at front of R.H. cylinder head).
2. Defective heater turn-on switch (will not close). Check by grounding switch feed wire.
3. If problem persists, refer to electrical circuit diagrams for wiring discontinuity.

NOTE: If problem does not occur in shop, it is probable that the system is turned on by the in-car sensor. Disconnect control head electrical connector to disarm the in-car switch. If the blower turns off (with the engine warmed up), ground the heater turn-on switch feed wire. If the blower now turns on (in low blower speed), the heater switch is probably defective.

IMMEDIATE HEATER TURN-ON IN COLD WEATHER

1. Defective (closed) heater turn-on switch (remove and check cold).
2. Defective (closed) in-car switch.
3. If problem persists, refer to electrical circuit diagram, and trace wiring continuity.

A/C DELAYED IN HOT WEATHER UNTIL ENGINE WARMS UP (UNLESS CONTROL LEVER IS IN "VENT" OR "DEF")

1. Defective (open) in-car switch.
2. Open in control head wiring harness (in-car switch circuit).
3. If problem persists, check wiring continuity in the in-car switch circuit. Refer to the wiring diagram, Fig. 1-4.

4. Auxiliary Vacuum Problem Diagnosis

Auxiliary vacuum functions are defined as those vacuum circuits in the automatic temperature control system which do not affect the temperature of discharge air. Specifically that would include all vacuum functions except the transducer, relay portion of the vacuum checking relay, and the programmer vacuum motor. Included in this section is one auxiliary electrical circuit, the compressor actuation circuit. A list of the auxiliary circuits is as follows:

1. Upper mode door vacuum circuit.
2. Lower mode door vacuum circuit.
3. Defroster bleed vacuum circuit.
4. Defroster door vacuum circuit.
5. Recirc door vacuum circuit.
6. Heater water valve vacuum circuit.
7. Auxiliary vacuum circuit check valve.
8. Compressor electrical circuit.

Because of the relative simplicity of each of the auxiliary vacuum circuits, the best diagnostic aid will be a clear understanding of the type of problem or complaint which would result from a malfunction in any of the individual circuits. Once the problem has been isolated to a specific circuit, diagnosis will generally consist of checking vacuum connections at one or two points. The following chart presents the types of problems most likely to be encountered in each of the auxiliary circuits. For more complex problems a procedure to completely qualify the vacuum system is presented in the last block of the diagnosis chart.

It should be noted that because of the interrelationship of the vacuum circuits, a leak in one circuit may reduce the vacuum supply to another circuit sufficiently to cause a malfunction of the second circuit. For example, a water valve vacuum hose disconnected may prevent the mode doors from moving full travel causing a split mode condition.

UPPER AND LOWER MODE DOOR ACTUATION PROBLEMS

The most likely malfunctions would be "no air conditioner operation" and "split mode operation". Vacuum is required to get air conditioner mode. Check the hose connections at the mode door upper and lower vacuum actuators. Split modes may occur because of malfunctions in either the upper or lower door circuit, or because of leaks in other auxiliary vacuum circuits. It is recommended that the auxiliary vacuum circuit test procedure listed on page 1-24 be used to isolate mode door vacuum problems.

DEFROSTER BLEED PROBLEMS

Actuation of the side (bleed) port of the defroster diaphragm is delayed by a porous flow plug inserted in the yellow-coded vacuum hose. Complaints relating to defroster bleed operation will generally be of two types:

1. No defroster bleed. Check hose connection at defroster bleed nipple of defroster vacuum actuator. If connections are satisfactory, porous plug is probably too restrictive. Replace plug. (Before installing new plug, check for vacuum in yellow line; and apply hose to nipple, without the plug, to check bleed door operation.)
2. Rapid fogging of windshield when heater turns on. Either there is no porous flow plug or installation of the plug is incorrect.

DEFROSTER DOOR ACTUATION PROBLEMS

The most common problem to be expected in this circuit would be "no air out of defroster outlets in "Def" setting". Vacuum to the defroster actuator is required for defroster operation.

1. Check hose connection (blue) at defroster actuator.
2. Check for vacuum at the control head purple hose.
3. If system stays in A/C mode at "Def", check vacuum circuit to determine why mode override did not occur. If problem persists, see auxiliary vacuum circuit test page 1-24.

RECIRC AIR DOOR ACTUATION PROBLEMS

The most likely problem to be encountered will be "no recirc air in Hi or Auto lever settings". Vacuum is required to obtain recirc air. Check hose connection at recirc air door. Remove vacuum delay plug to check for adequate vacuum at "Hi" and "Auto" settings and 65° dial. If vacuum is available but door won't move with plug in circuit after approximately 3 minutes, replace plug.

HEATER WATER VALVE CONTROL PROBLEMS

The water valve is a normally open valve requiring vacuum to close off water flow. It would be very difficult for a customer to recognize a problem in the water valve circuit by "no heater water shut-off"; however, a leak in that circuit may manifest itself by reduced vacuum levels available in other vacuum functions. The most likely such complaint would be a split mode delivery. Use the external vacuum circuit test presented below to isolate vacuum problems.

AUXILIARY VACUUM CIRCUIT CHECK VALVE PROBLEMS

The check valve for the auxiliary vacuum circuit is located in the programmer checking relay assembly. A malfunction of this check valve will probably result in complaints of loss of a specific function (such as "A/C shuts off") during accelerations or mountain driving. The check valve may be checked with the system operating by disconnecting and plugging the black hose feeding the programmer checking relay. The vacuum functions (a vacuum gage in the purple hose or the system in A/C mode) should hold. If they do not hold, reinstall the black hose, and pinch the purple hose. If the functions now hold, the check valve is bad. If the functions continue to leak down, there is a circuit leak further upstream. Use the auxiliary vacuum circuit test below to locate the leak.

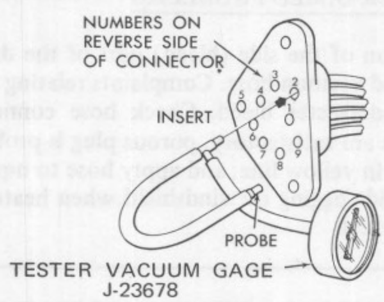
COMPRESSOR ELECTRICAL PROBLEMS

Malfunctions in the compressor electrical circuit would result in complaints of "no cooling", or "insufficient cooling". Perform the following checks:

1. Blown thermal fuse or disconnect at thermal fuse. Refer to Note 6.
2. Blown 15 amp fuse in fuse block.
3. Electrical disconnect at compressor clutch coil.
4. Electrical disconnect at compressor ambient switch.
5. Electrical disconnect at the three-way electrical connector inside the car, to the right of the programmer.
6. Backed-out terminal or disconnect at the control head electrical connector.
7. Defective compressor ambient switch.
8. Open in wiring harness. Refer to electrical circuit diagram, Fig. 1-4.

AUXILIARY VACUUM CIRCUIT TEST PROCEDURE

Remove car vacuum harness plug from programmer valve, which should direct all airflow to floor except for defroster bleed air. Connect tee with short hose and union to J-23678 tester vacuum gauge hose as shown in sketch at right, inserting tee in Part No. 2 of harness plug and probing each of the other ports in turn. Make sure that control head lever is set as specified for each step, and cover up probe on Ports 3 and 9 when called for, to seal off other circuit branches. For each step, full vacuum should be read after actuator-travel is completed.



Control Lever	Probe Port:	Hose Color	Cover Up	Other Hoses In Circuit	Action Expected
Bi-Level	None	Black	Probe	Yellow	Defroster door moves to "bleed" position
Bi-Level	1	White	None	None	Hot water valve closes - Check air in "max. heat"
Bi-Level	3	Red	Port 9	Purple, Tan	Lower mode door moves to A/C position
Bi-Level	4	Orange	None	None	Recirc. door opens - 1-2 min. delay
Lo	5	Chartreuse	Port 9	Purple	Checks control head vacuum leakage
Lo	6 or 8	Green	None	None	Upper mode door moves to A/C position
Hi	7	Dark Brown	None	Tan	Lower mode door moves to A/C position
Def	9	Purple	Port 3	Red, Dk. Blue	Defroster door moves to full "DEF" position

A low vacuum reading in any step indicates a leak in control head valve or in the hoses and components listed in that step. If some function is missing even though full vacuum is available, reconnect harness plug to programmer and check vacuum at extreme end of hoses involved, to distinguish between a pinched hose and a mechanical bind in actuator or door.

5. Refrigeration Problem Diagnosis

A properly-operating refrigeration system will maintain evaporator core cooling surfaces at 32°F. when refrigeration is required, if engine speed is sufficient and the heat load on the system is not excessive. A refrigeration problem exists when there is a defect in one of the refrigeration components or in the overall system which interferes with this function. In most cases, the defects will result in higher-than-normal core temperature and loss of effective cooling; in a few specific cases the core will operate at a temperature lower than 32°F. and condensate in the core will freeze and block airflow, again causing a loss of cooling.

It is important to separate refrigeration problems from temperature control problems. This can be done simply during the control system function test.

1. Perform control system functional test described on Page 1-17.

2. If system operates properly, return lever to AUTO and set dial at 65°.

3. Install thermometer in right hand air conditioner outlet. Wait approximately one minute. Thermometer should read 40° to 50° unless temperature or humidity of test area is excessively high.

4. If the discharge temperature is significantly higher than 50°, disconnect and short across ambient sensor electrical connector. Check to assure that the air-mix door link arm is pivoted fully to the "Max A/C position.

5. If the discharge air temperature drops to 50°, or below as a result of shorting the sensor, the problem belongs in the Temperature Control category.

6. If the temperature does not change and is still significantly higher than 50°, a refrigeration problem exists.

Many refrigeration problems can be readily diagnosed without connecting the refrigeration gage set or performing the more extensive Cooling Capacity Performance Test. Defects causing a problem of this sort are listed in the following chart:

NO REFRIGERATION OR INSUFFICIENT REFRIGERATION

Gage set usage not required for diagnosis.

1. No voltage to compressor clutch - check thermal fuse. Refer to Note 6.
   Check compressor electrical circuit, including compressor ambient switch and ground wire.
   Check 15 amp A/C-heater fuse.
2. Compressor seized – clutch plate slips.
   Clutch plate moves rearward and engages pulley but pulley cannot drive it.
3. Compressor belt slipping.

Listed below are a number of defects which will cause a relatively minor loss of capacity (gage set required).

1. Excess bugs, leaves, etc. on condenser will cause higher-than-normal head pressure.
2. Excess oil or refrigerant in system.
3. Air in system –
   Will cause higher-than-normal head pressure.
   Will also cause internal corrosion of parts.

(NOTE: Let system stand inoperative overnight. With the same gage, check first the low side pressure and then the high side pressure. If the high side pressure is significantly higher than the low side pressure, there is probably air in the system. Purge, evacuate and recharge.)

The chart on Page 1-26, lists defects that require connecting the gage set and running the Cooling Capacity Performance test (refer to Note 51).

REFRIGERATION DIAGNOSIS CHART – VALVES-IN-RECEIVER SYSTEM

Observe refrigeration system in areas listed below while engine operates at 2,000 RPM with control lever in "HI" and temperature dial at 65. All windows should be open and hood should be up. Blower motor should be disconnected when required in chart.

System Condition	OBSERVED OPERATING CONDITIONS									System Correction
	Outlet Air Temp.	Sight Glass	Head Pressure at Ambient Temperature				Evaporator Pressure	Evaporator Outlet Pipe Temperature	Oil Bleed Line Temperature	
			70°	80°	90°	100°				
Normal	40 - 50°		160#	190#	220#	250#	28-32 PSIG		Warm	
		Clear	200#	230#	260#	290#		Cold		
With Blower Lead Off	No Air Flow		Lower than Normal				Maintains Pressure		Gets Cold	
Refrigerant Charge Low *	Warm	Foamy or Bubbly †	Lower than Normal				Normal to Low	Warm	Cold	Find Leak. Repair and Recharge.
VIR Liquid Pickup Tube Screen Partially Plugged *	Warm	Foamy or Bubbly	Low				Normal to Low	Cool or Warm	Cool or Warm	Clean Screen and System as Required. Change Desiccant and Recharge.
Refrigerant Charge Lost *	Warm	Clear	Very Low				Very Low	Warm	Warm	Find Leak. Repair, Change Desiccant and Recharge.
Refrigerant Overcharge Blows Relief Valve on Hot Days	Normal	Clear	High				Normal	Cold	Warm	Recharge to the Specified Charge.
X-Valve Diaphragm Discharged (Failed Closed) * **	Warm	Clear	Low				Low***	Warm	Cold	Replace X-Valve Capsule.
Vacuum Loss in STV Capsule Bellows or Valve Piston Stuck Closed * ††	Warm	Foamy or Bubbly	Low				High	Warm	Warm	Replace STV Capsule.
STV Stuck Open * ***	Cold Evaporator May Ice Up Affecting Air Flow	Clear	Low				Normal to Low ***	Cold	Warm	Replace STV Capsule.
STV Setting too High	Warm	Clear	Normal				High	Cool to Warm	Cool or Warm	Replace STV Capsule.

* – Superheat Switch May Close and Thermal Fuse Link Open to Shut Off the Compressor.

** – Allow the System to Warm Up and Equalize Before Repeating the Test. If the Condition Doesn't Recur the System has Excess Moisture Causing Ice to Form in the Valve. Discharge the System, Replace the Bag of Desiccant, Evacuate the System for 30 Minutes and Recharge.

*** – Goes to Low Pressure or Vacuum with Blower Disconnected.

† – May be Bubbly or Clear with Blower Disconnected.

†† – System Will Not Accept Charge.

6. Low Refrigerant Flow Detection System Diagnosis

The thermal fuse and superheat switch is designed to protect the air conditioning compressor against damage when refrigerant flow to the compressor is inadequate due to low or lost charge or valve malfunction.

During normal operation, current flows through the control head switch, ambient switch and thermal fuse to the clutch coil to actuate the compressor clutch. If a partial or total loss of refrigerant occurs in the system, the contacts in the superheat switch close, as the switch senses low system pressure and high suction gas temperature. When the contacts close, current flows to energize a resistor-type heater in the thermal fuse.

The resultant heat melts the fuse link and the circuit to the compressor clutch coil opens. Compressor operation ceases and damage due to low refrigerant flow is prevented. The superheat switch must be closed for approximately 2 minutes to blow the fuse.

Before thermal fuse replacement, the cause of refrigerant loss must be corrected.

DIAGNOSIS OF LOW REFRIGERANT FLOW DETECTION SYSTEM

Compressor will not operate if thermal fuse is blown. To check for blown fuse, remove harness connector and short between terminals "B" and "C" in the harness connector. If compressor now operates but did not before, thermal fuse is blown; proceed with Step 1. If compressor does not operate refer to compressor electrical problems on Page 1-24.

1. Inadequate Refrigerant Charge – Check for clear sight glass as described in Note 48. If refrigerant is low, leak test, recharge. NOTE: Disconnect superheat switch during recharging. Install new thermal fuse.
2. Thermal Fuse Was Blown During Previous Charging – Check to assure adequate refrigerant charge and install new thermal fuse.
3. Defective Expansion Valve (failed closed) – Replace X-valve capsule, recharge and install new thermal fuse.
4. Defective Superheat Switch – Before removing switch, check to assure a good electrical connection between switch case and compressor head. If ok, remove switch and check operation as follows: At temperatures below 100°F the switch should be open (open circuit between terminal and case). Switch should close with sensing tube held in match flame 15-20 seconds. If switch does not open and close as described, replace switch.
5. New thermal fuse blows immediately after installation – Check for short in wiring to switch. Possible causes of short are as follows:
   A. Pinched, broken or bare wires.
   B. Boot off of connector at switch.
   C. Connector on thermal limiter reversed.
   D. Connector shorted to switch body.
   E. Refrigerant pipes cutting through boot at switch.
   F. Connector off center on switch pin.
6. STV Defective (stuck open) – This condition can be diagnosed by running the engine at fast idle with the blower disconnected. Evaporator pressure pulls down considerably under the normal 29.5 P.S.I.

7. A.T.C. Tester—J-23678

The A.T.C. Tester, J-23678, is designed for on-car diagnosis of control problems utilizing car electrical and vacuum supplies. The Tester will not only locate the problem area but will also isolate the individual malfunctioning component. Instructions are furnished with the tester.

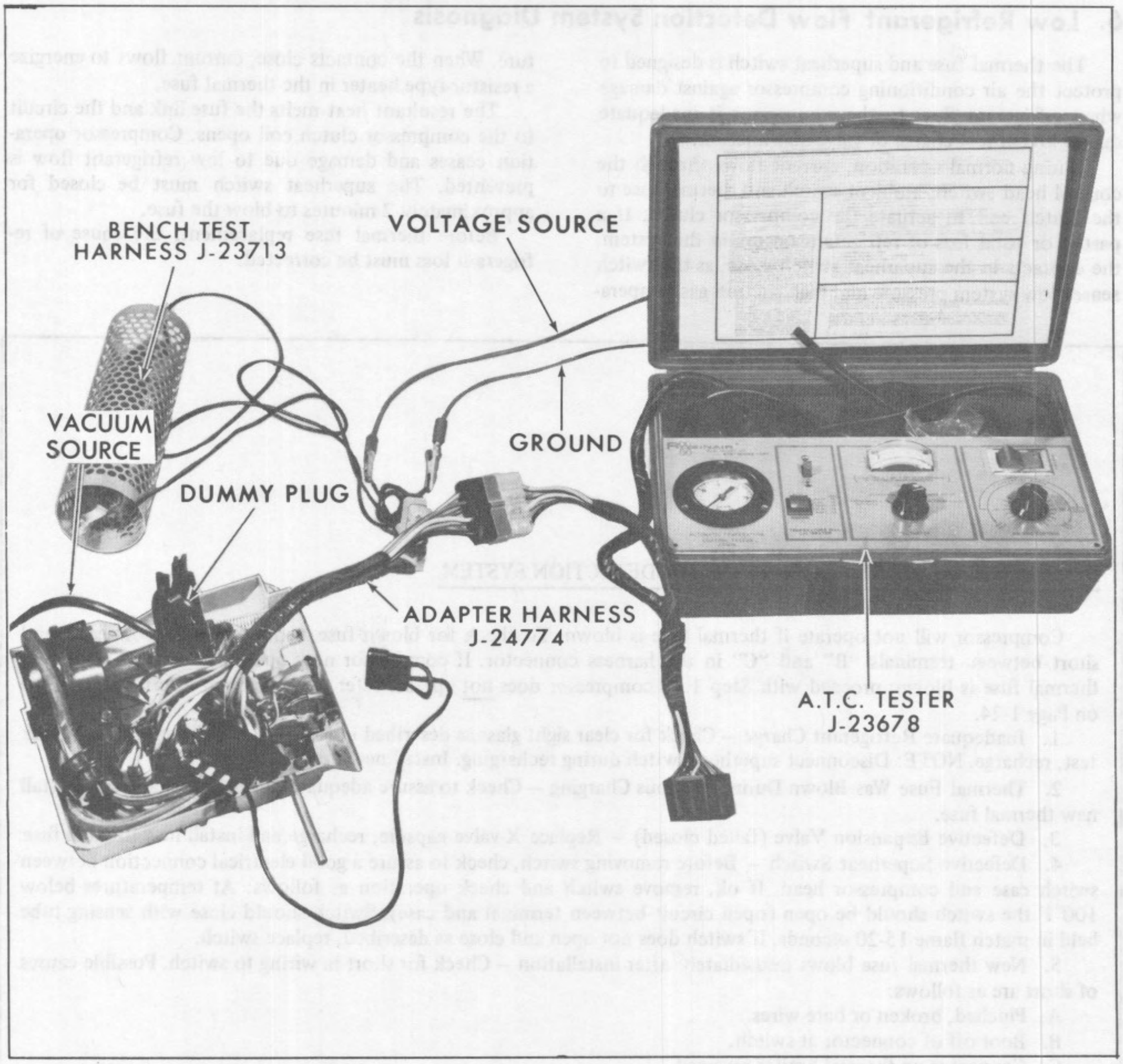


Fig. 1-5 Bench Test Harness

8. Blower Swith Bench Test (Using J—23713 Bench Test Harness)

The ATC Programmer Test Harness, J-23713, is a substitute blower motor resistor that is used with ATC Tester, J-23678 and Adapter Harness J-24774, a vacuum supply and a 12-volt source to bench-test the programmer, Fig. 1-5.

1. With ATC Programmer on bench, plug harness of ATC Tester, J-23678, into appropriate end of Adapter Harness J-24774.

2. Connect opposite end of Adapter Harness J-24774 to programmer connector.

3. Plug substitute blower resistor, J-23713, into female plug of harness on Tester, J-23678.

4. Connect positive and negative leads of J-23713 Harness to a voltage source.

5. Connect dummy vacuum plug provided with J-23678 into vacuum source.

6. Place voltmeter knob of J-23678 at 6 and place manual-automatic switch in manual position.

7. Rotate manual control knob back and forth (from max. cold to max. A/C). Voltage should drop, then increase, in steps. Voltage variation will be less than when performed on car.

THEORY OF OPERATION
FRONT AIR CONDITIONER—ALL SERIES

Information pertaining specifically to the 1974 Air Conditioning System is found in this section. Components not mentioned are the same as the 1973 system presented in the 1973 Shop Manual.

Air Conditioner Distributor

The A/C distributor is a large plastic duct attached to the rear surface of the heater. It receives air from the heater and distributes it to the left-hand A/C outlets through a flexible air hose. Air is delivered to the center and right-hand outlets through a plenum duct behind the instrument panel pad.

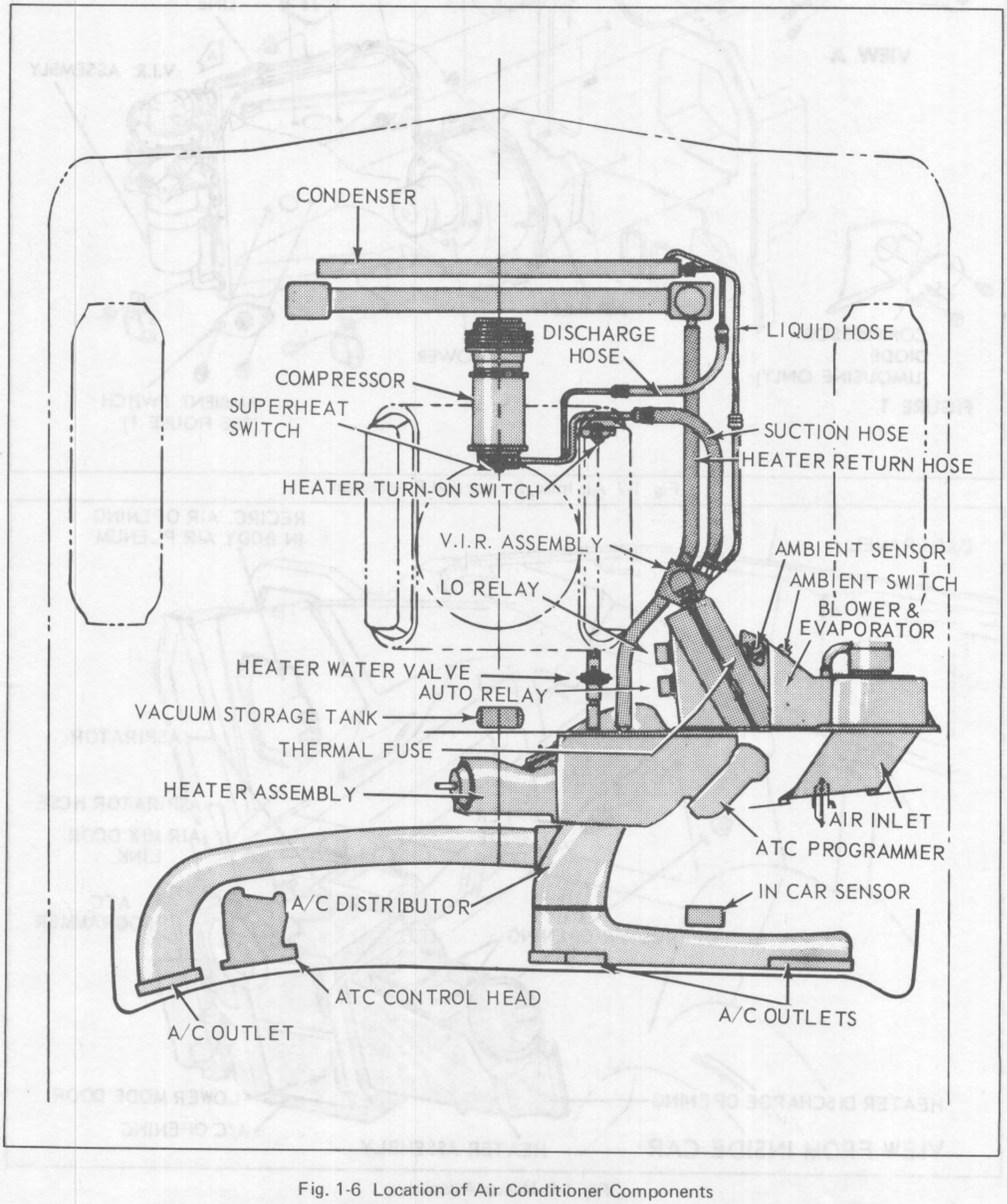


Fig. 1-6 Location of Air Conditioner Components

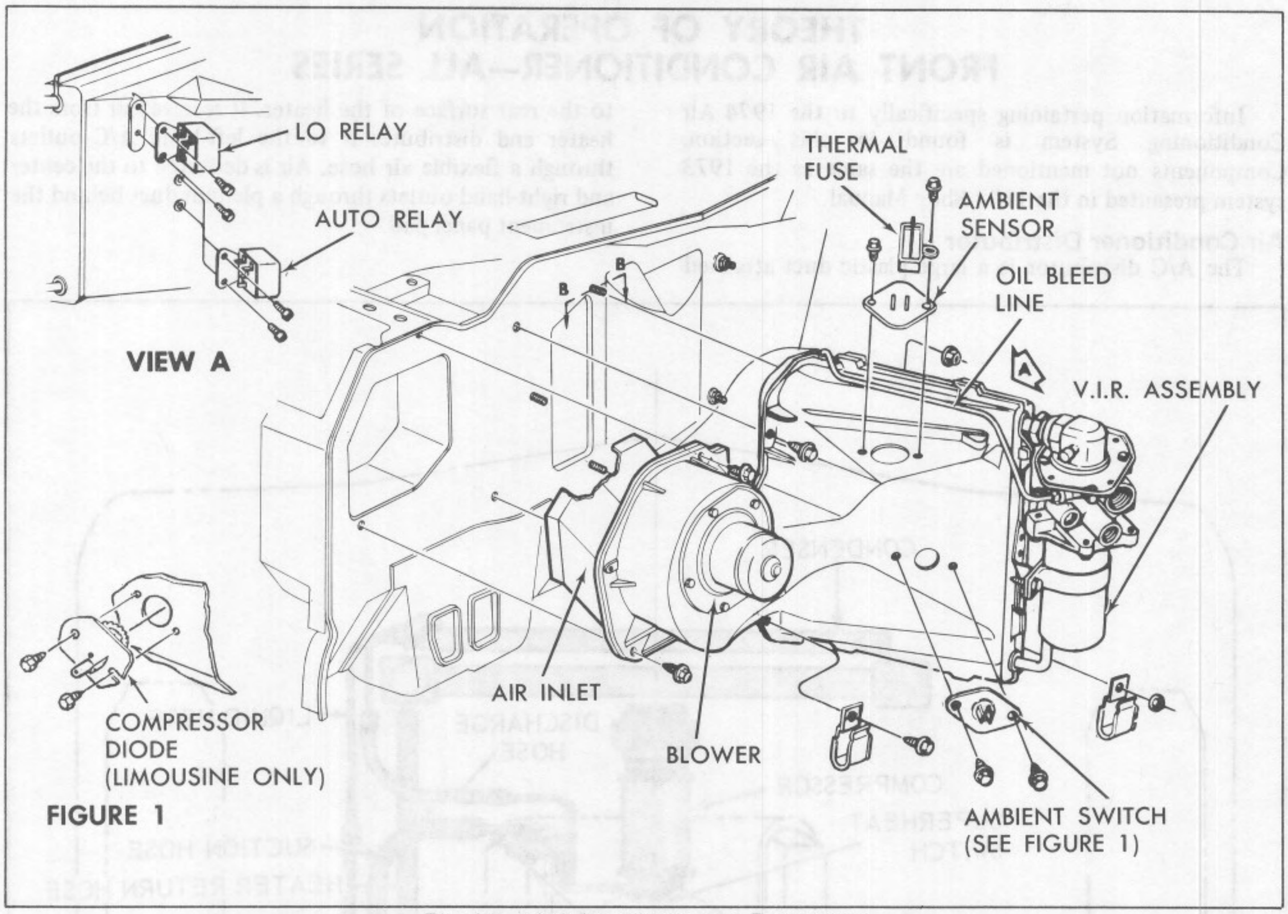


Fig. 1-7 Air Inlet, Blower and Evaporator

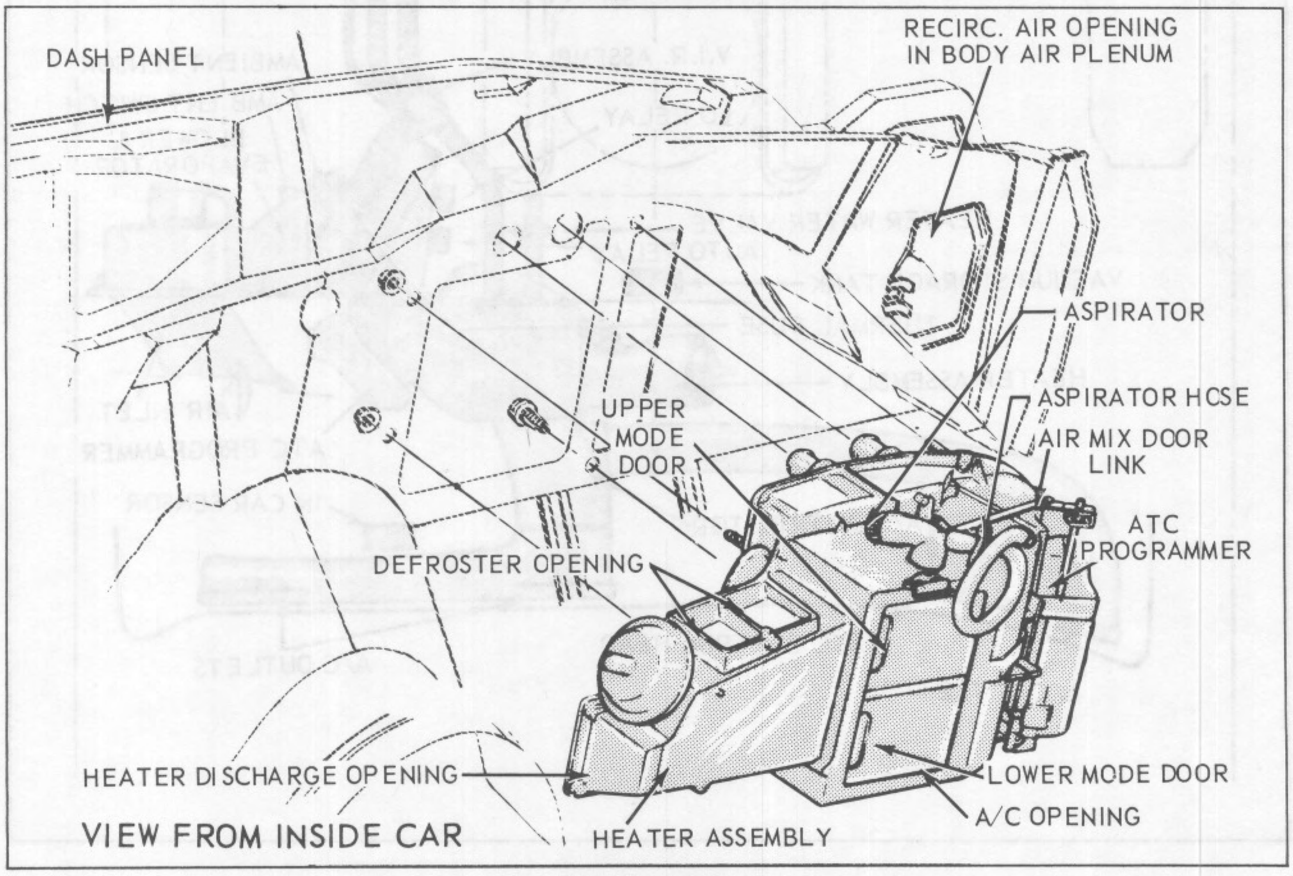


Fig. 1-8 Heater Assembly

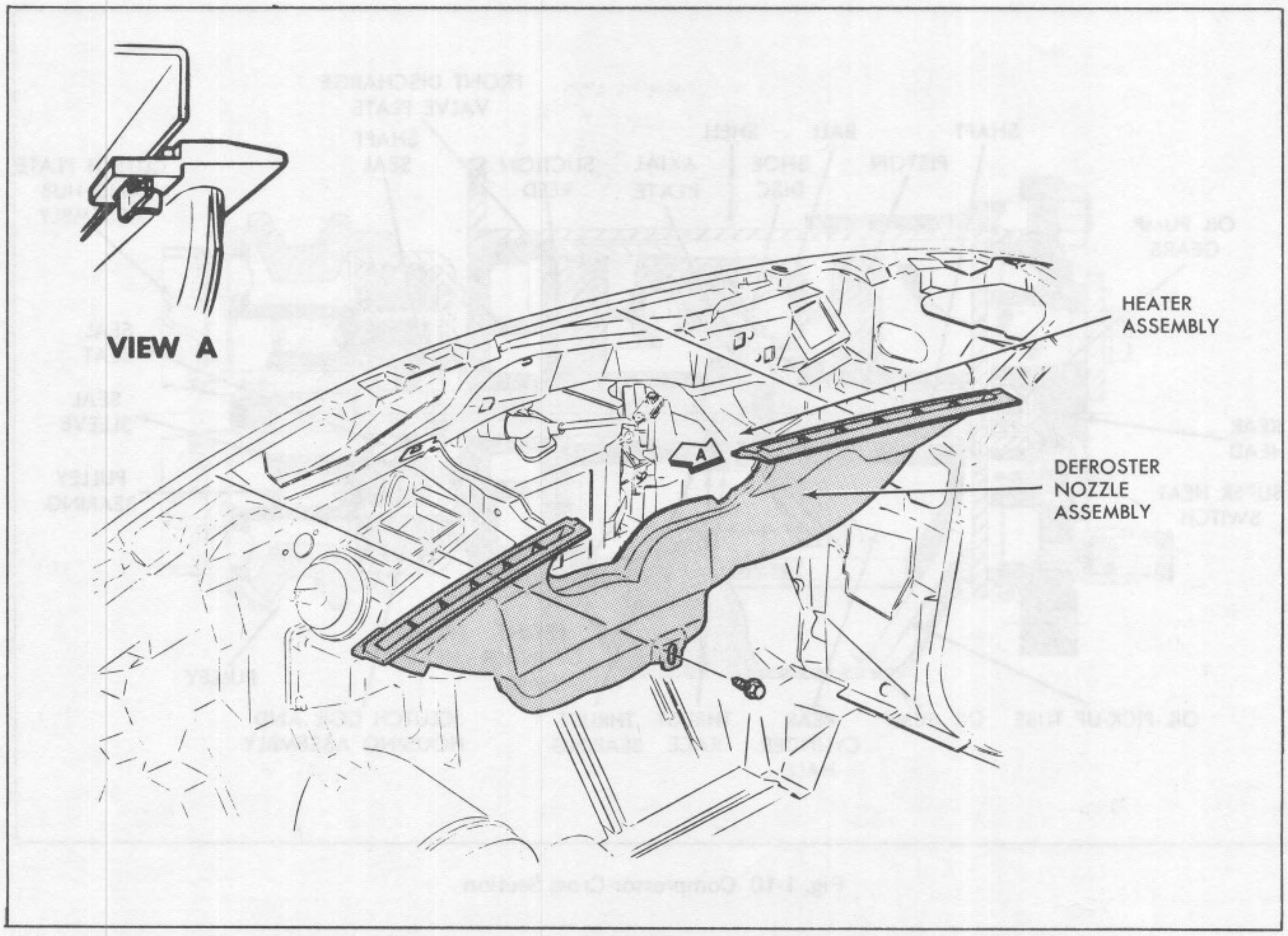


Fig. 1-9 Defroster Nozzle

Air Conditioner Outlets

Four outlets are located in the instrument panel; one at the left side of the cluster, two in the center of the pad and one at the right-hand side. Each outlet provides an air stream whose direction can be controlled independently. The outlet may be rotated to provide a vertical air adjustment while the knob is used to provide horizontal adjustment. Air flow may be stopped altogether from each outlet by moving the shut-off knob below the outlet.

A moderate flow of cool air to the floor is provided by two small plastic outlets located on the sides of the A/C distributor. These outlets can be rotated to obtain a more indirect flow of air to the floor area, if desired.

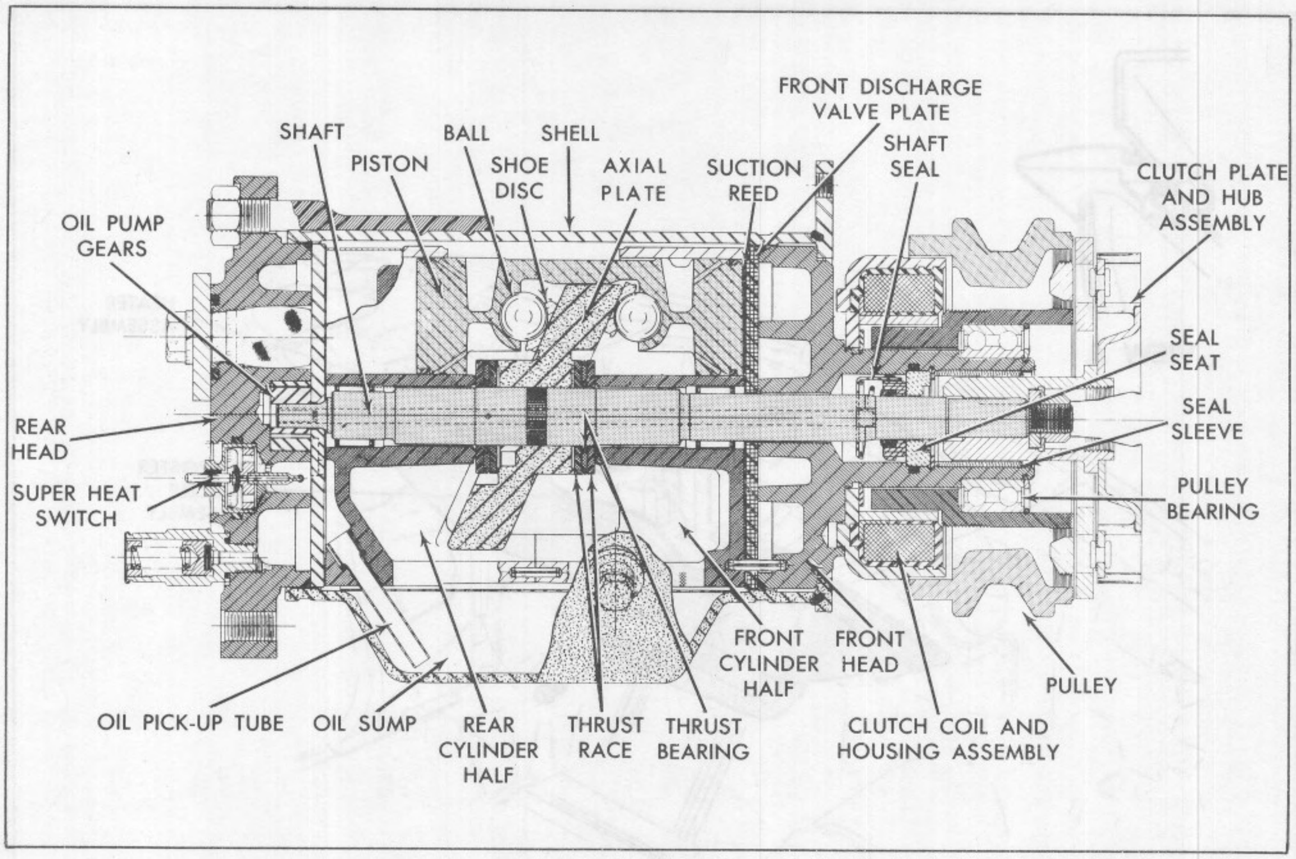


Fig. 1-10 Compressor Cross Section

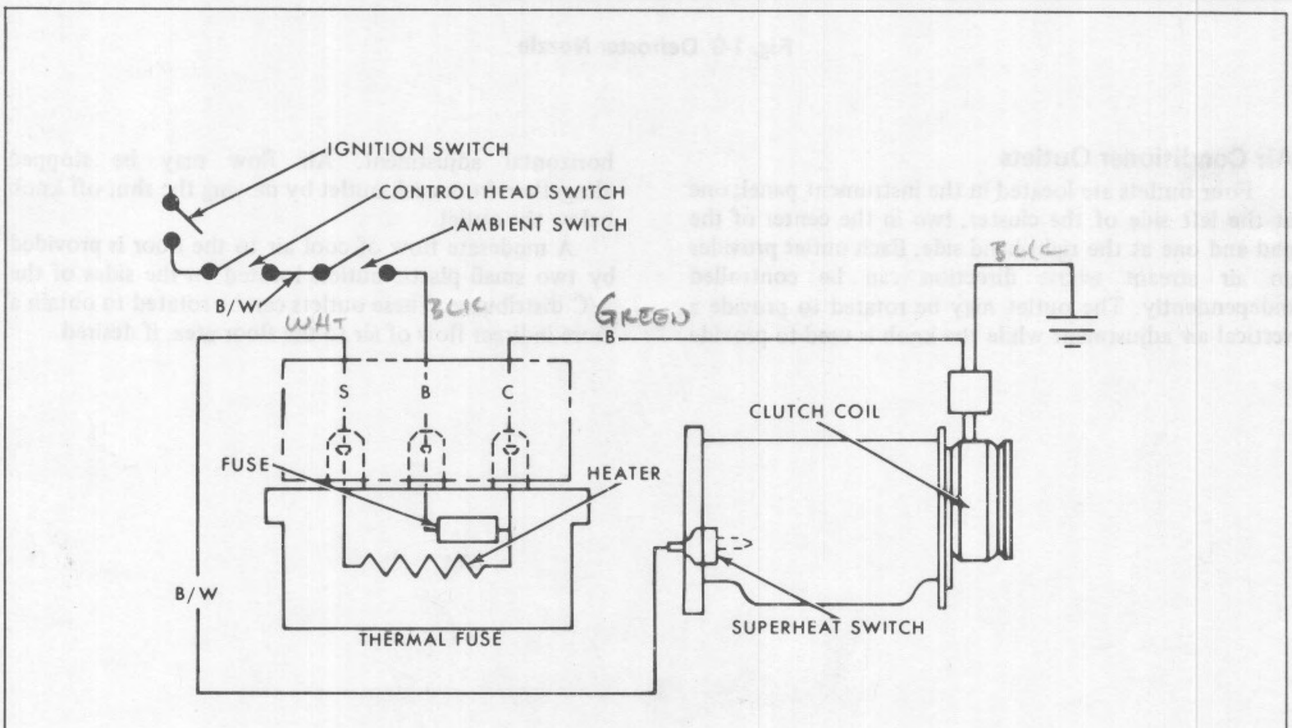


Fig. 1-11 Low Refrigerant Flow Detection System Electrical Circuit

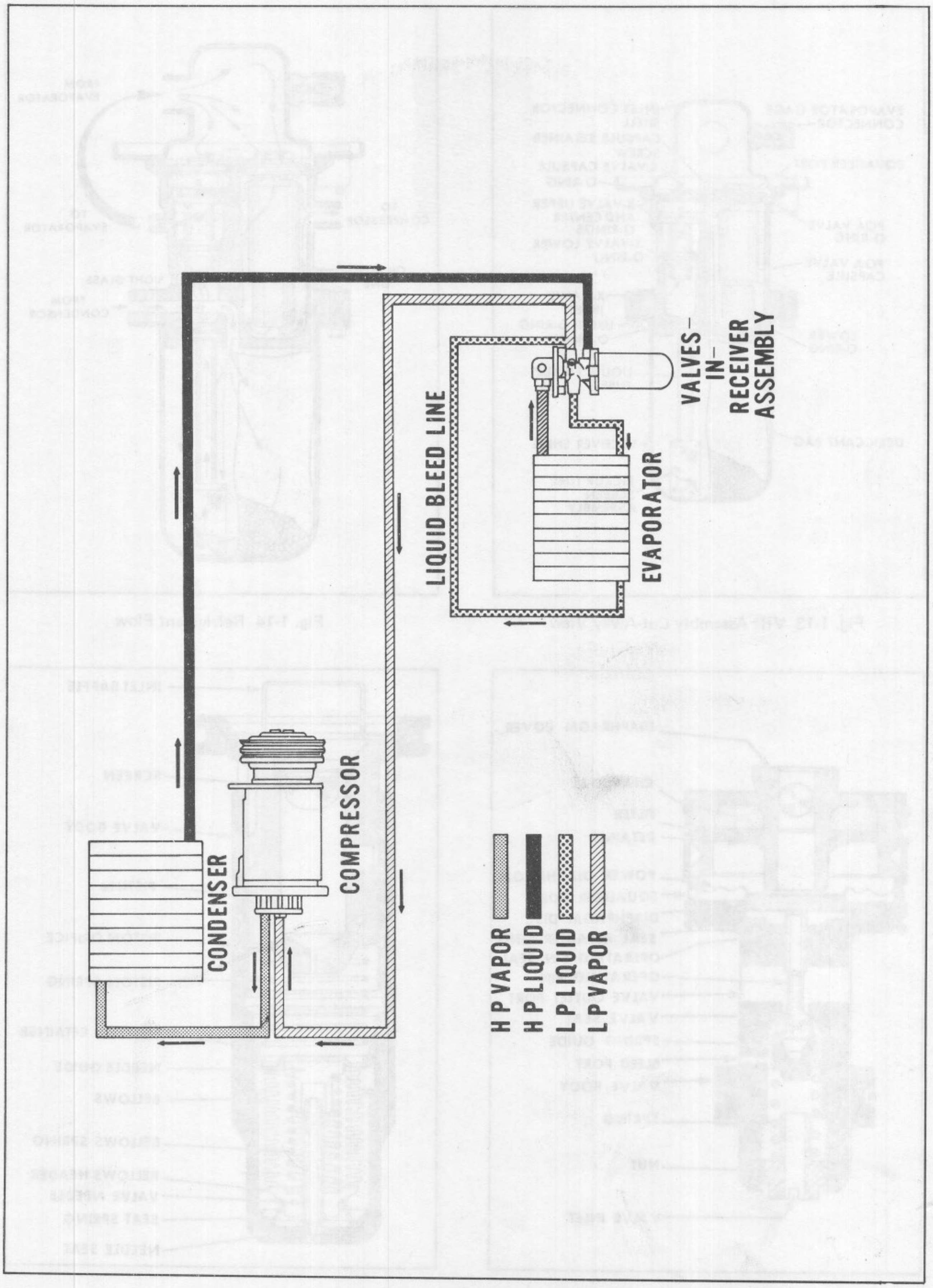


Fig. 1-12 Refrigeration Circuit

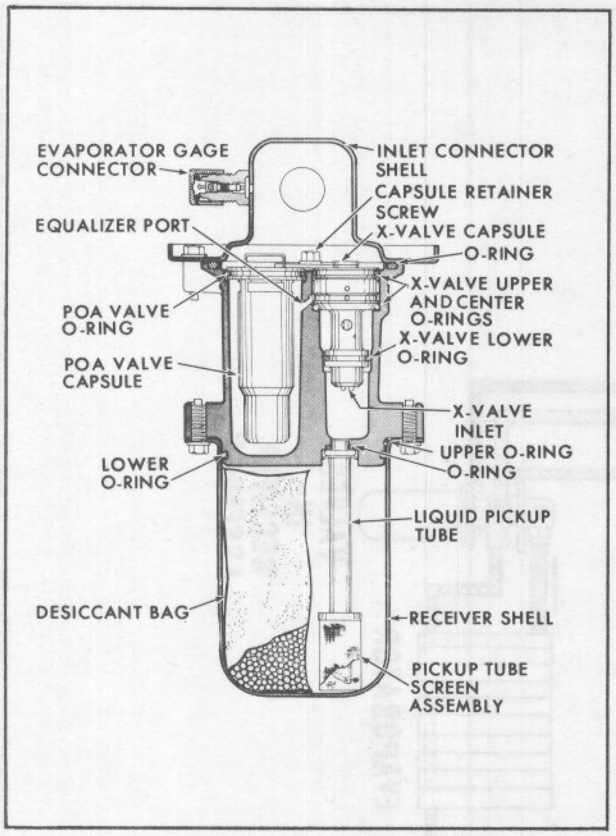


Fig. 1-13 VIR Assembly Cut-Away View

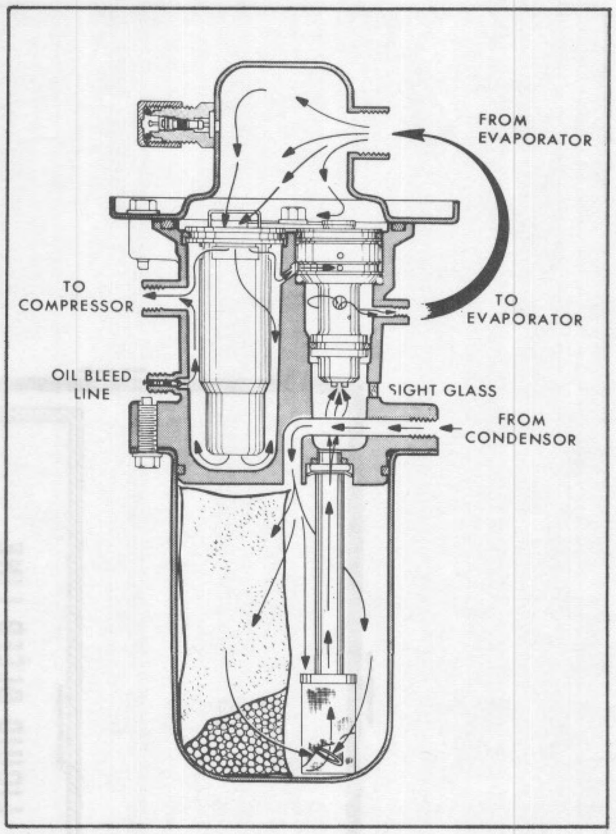


Fig. 1-14 Refrigerant Flow

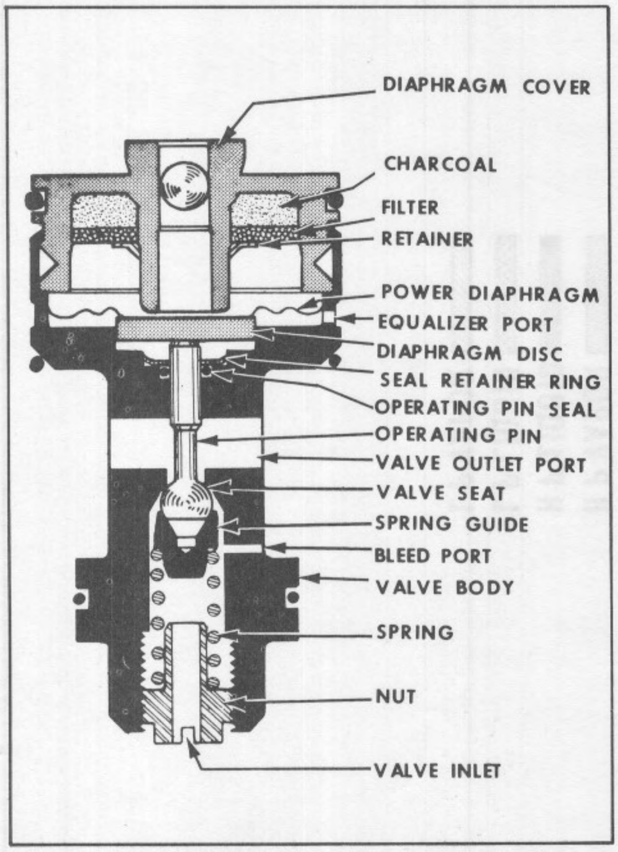


Fig. 1-15 Expansion Valve

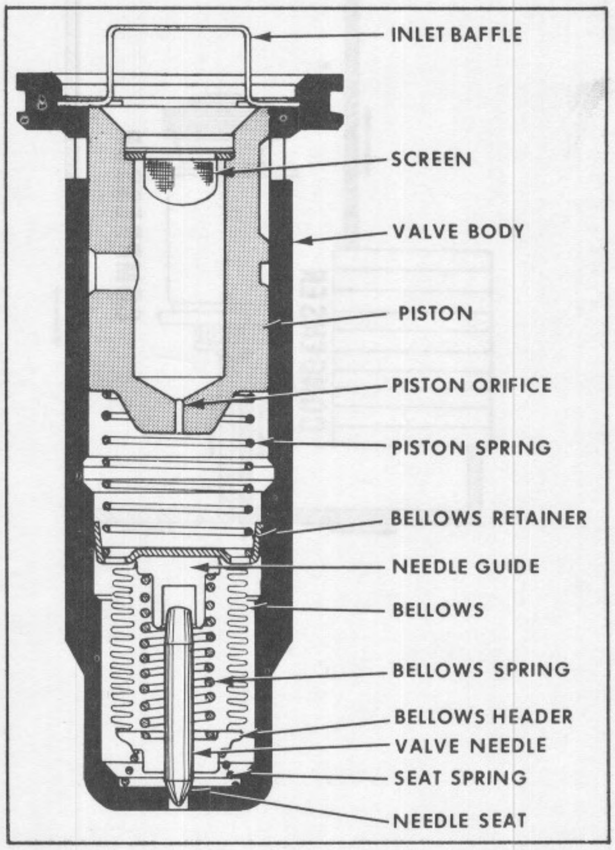


Fig. 1-16 STV Valve

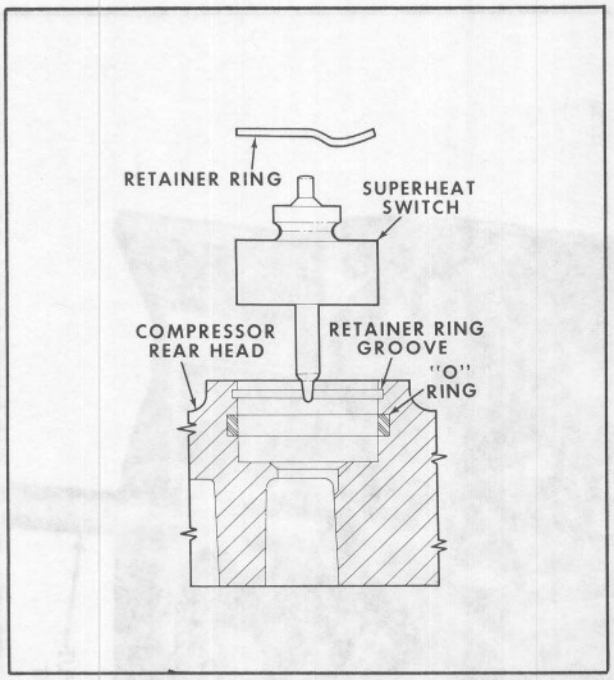


Fig. 1-17 Superheat Switch Retainer

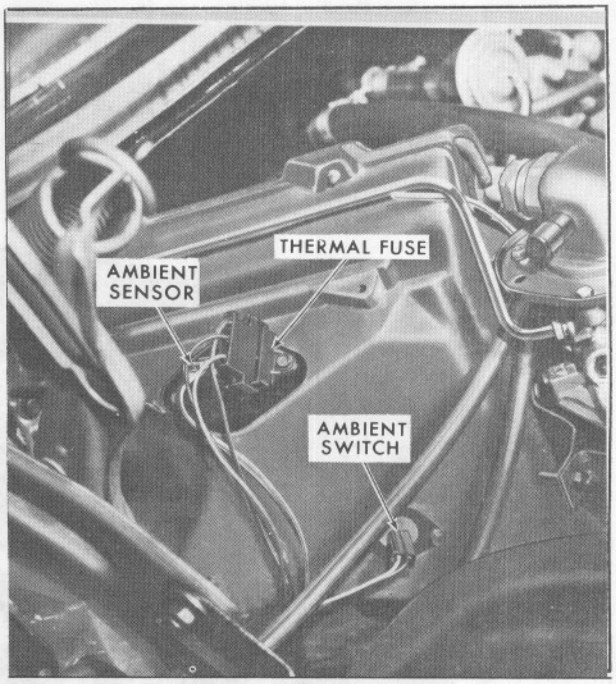


Fig. 1-18 Ambient Sensor and Switch

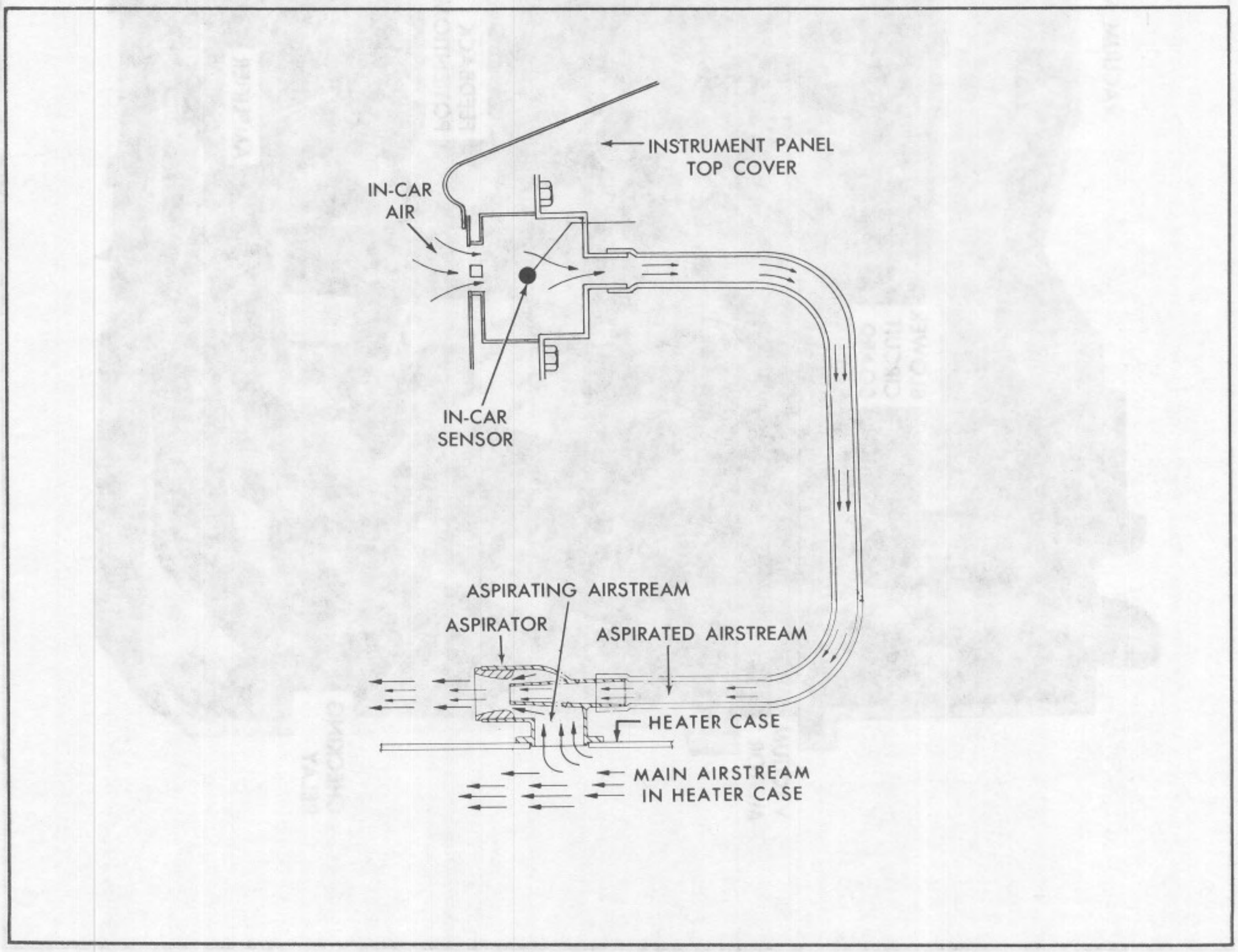


Fig. 1-19 In-Car Sensor Aspirator

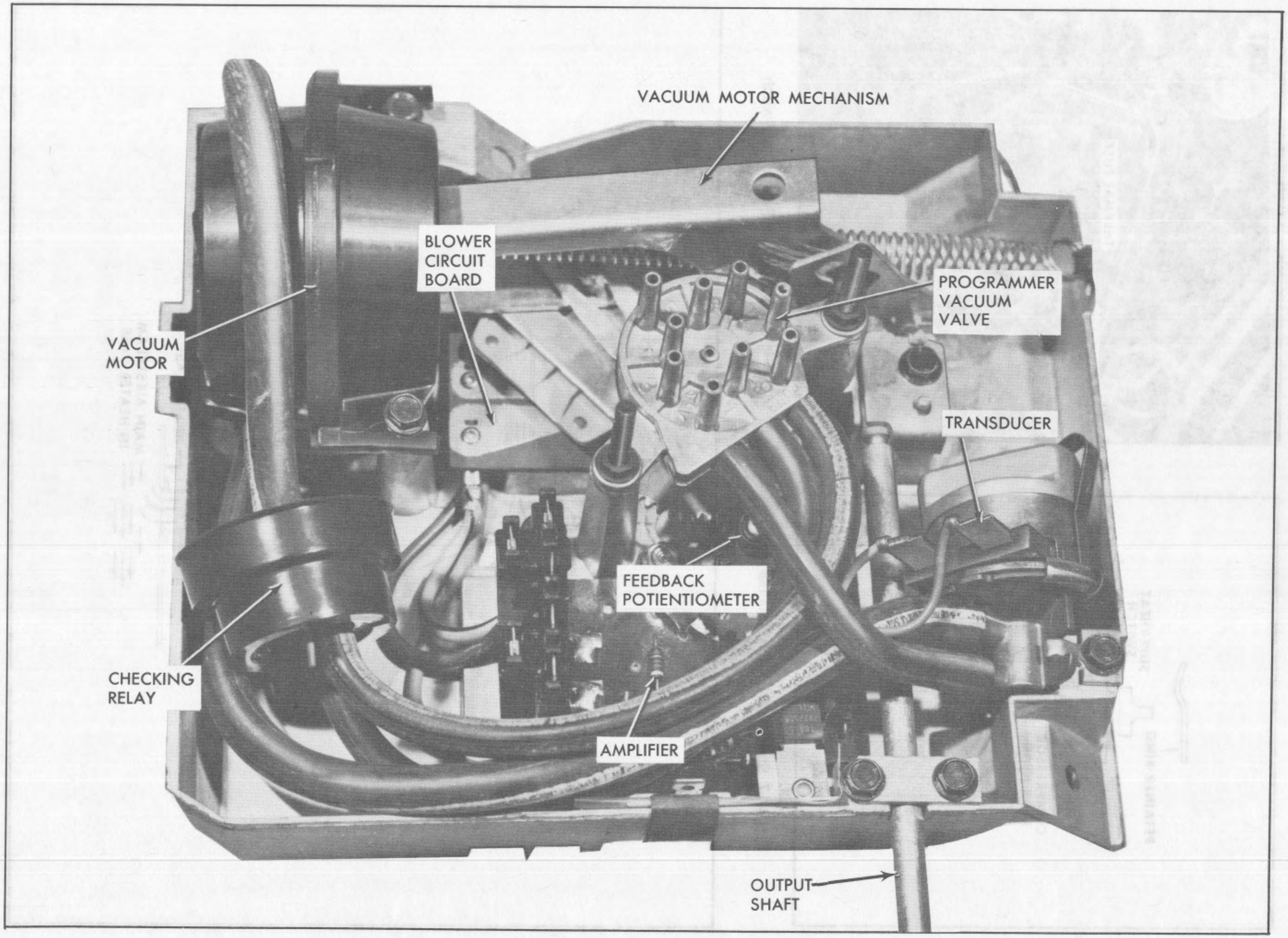


Fig. 1-20 Programmer

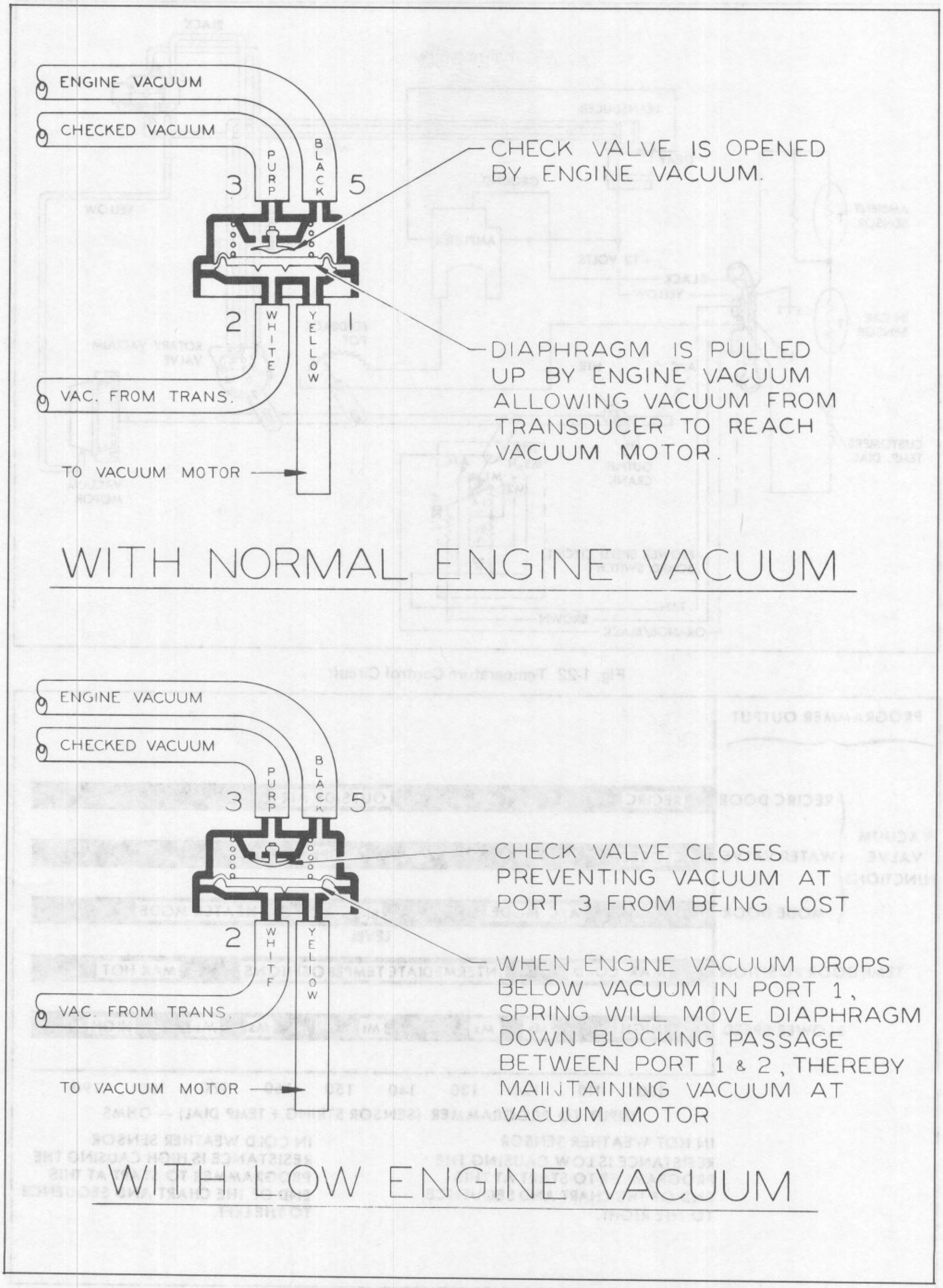


Fig. 1-21 Operation of Vacuum Checking Relay

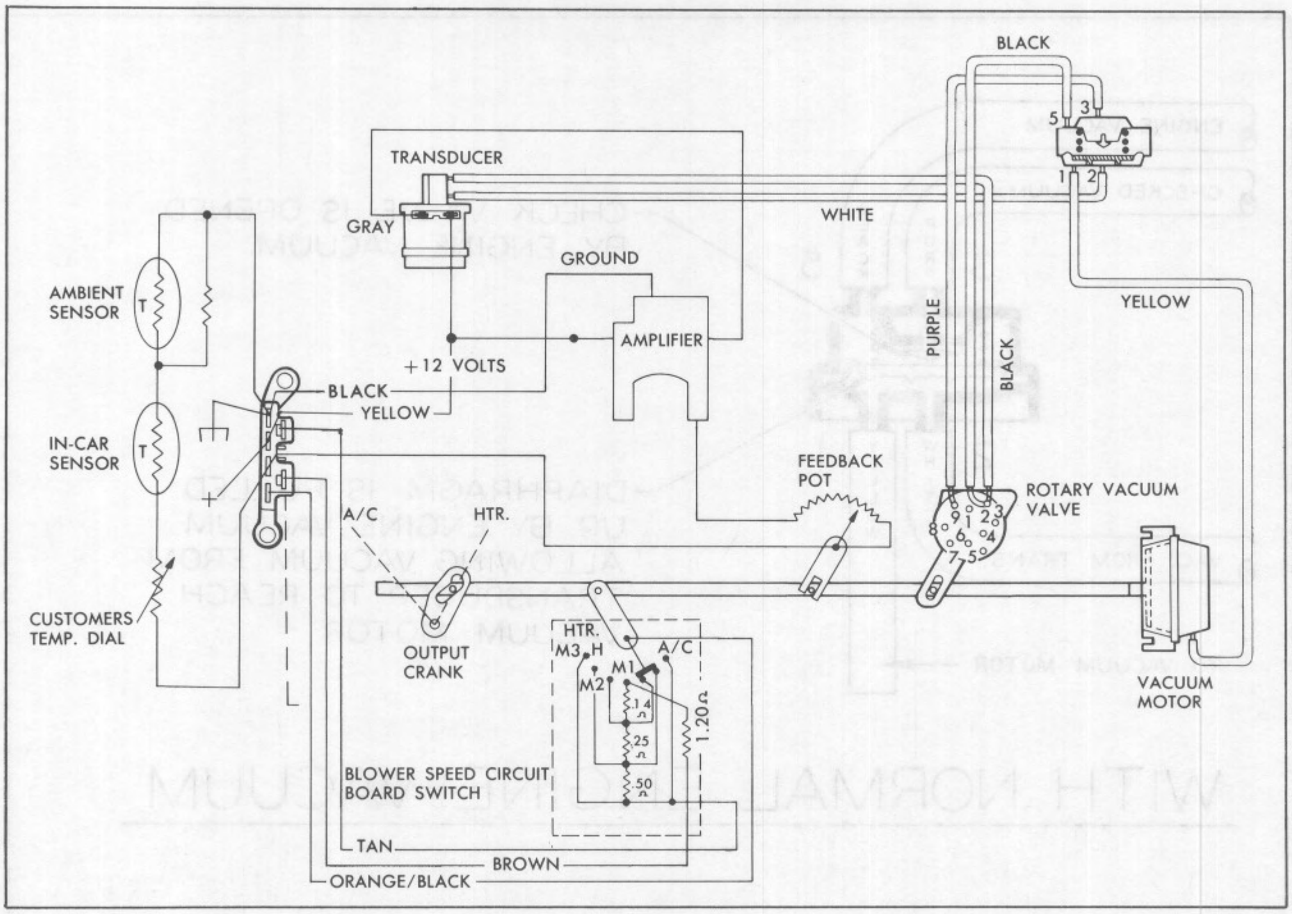


Fig. 1-22 Temperature Control Circuit

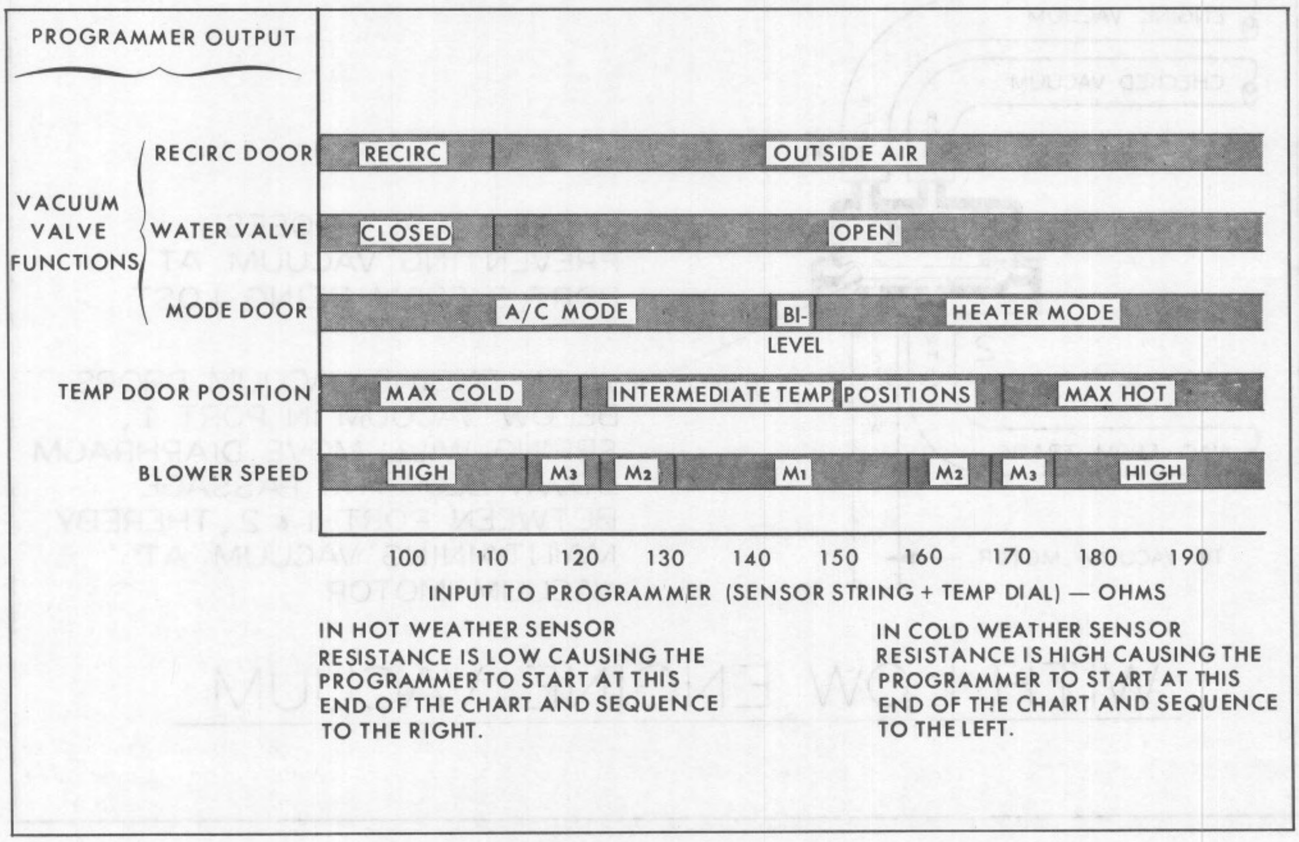


Fig. 1-23 Programmer Input-Output Chart

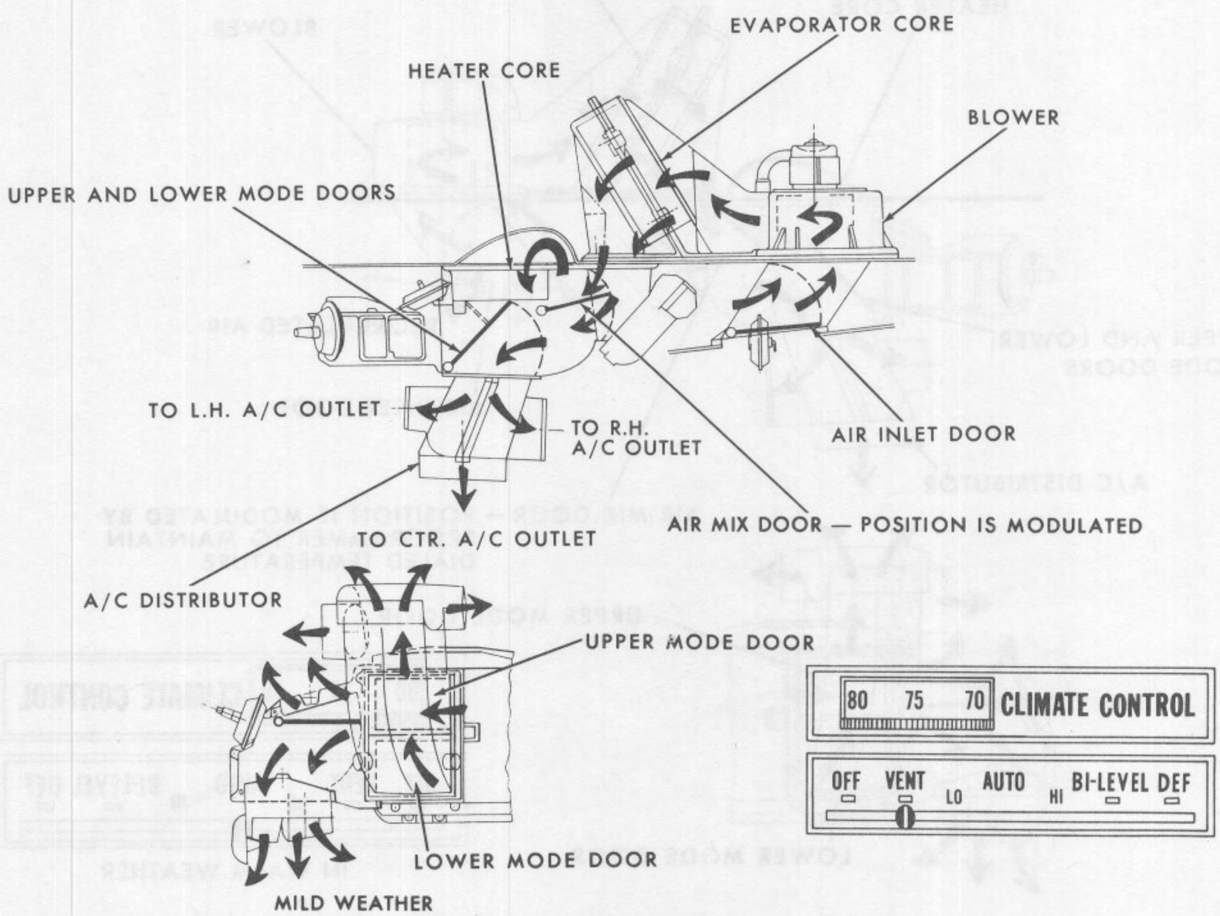


Fig. 1-24 Air Flow At Vent

VENT . Outside air is circulated at a fixed LO blower speed through the evaporator and heater assembly and discharged into the passenger compartment from the air conditioning or heater outlets. Since the compressor is disengaged at this setting, the ability of the system to maintain the dial temperature is restricted. It may be necessary to set the dial approximately 5° cooler than normal to maintain comfort at 50° to 70°F. ambient temperatures.

In the upper part of the usable range of this setting (approximately 50°F. to 70°F.), air will be delivered from the air conditioner outlets. Below 50°F., air will be delivered in BI-LEVEL fashion - from both the air conditioner and heater outlets.

The vent setting is designed so that it is possible to maintain comfort at ambient temperatures from 30°F. to approximately 70°F. without having the compressor operate.

In some situations (high sunload or excessive humidity) this setting may not provide comfort or windows may tend to become fogged. Under these conditions, the control lever should be returned to the "AUTO" setting.

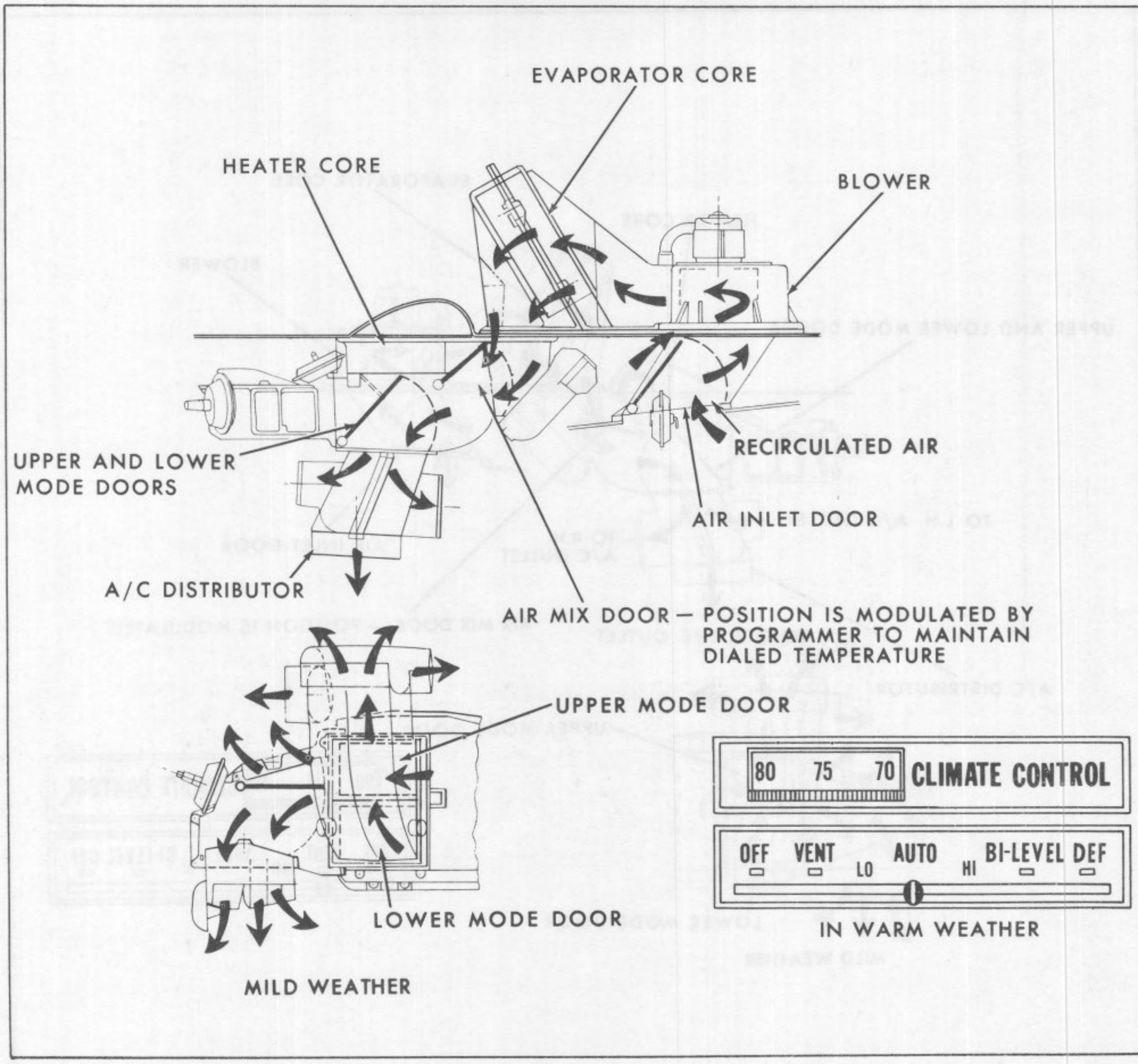


Fig. 1-25 Air Flow At "Auto" and "Hi" Warm Weather

AUTO - Regulation of blower speed, discharge air temperature, air delivery mode, system turn-on and compressor operation is accomplished automatically to maintain the temperature on the dial and to provide comfort.

Four blower speeds, HI, MED_3, MED_2, and MED_1 are utilized. If the car interior is significantly hotter or colder than the temperature on the dial, the blower will start at high and then sequence down to lower speeds as the dial temperature is approached.

Discharge air temperature will be varied automatically between approximately 45° and 150°. If the discharge air temperature is above approximately 90°, the air will be delivered from the heater outlet below approximately 75° it will be delivered from air conditioner outlets. Between these temperatures, air is provided from both the heater and air conditioner outlets (Bi-Level operation).

If the car interior is above approximately 75°, the system will turn on immediately when the car is operated. If the car is below 75°, system turn-on will be delayed, if the engine is cold, until engine water reaches approximately 120°.

Compressor operation is provided at all ambient temperatures above approximately 32°F even when not required for cooling, to assure maximum dehumidification of the air.

Outside air is utilized as air supply for the system except when maximum A/C is called for.

HI - Operation at this setting is identical to that provided at "Auto" except that the blower operates at a fixed maximum speed. This setting provides the quickest possible cool down under extremely hot ambient conditions.

SYSTEM RESPONSE								
CONTROL LEVER SETTINGS	BLOWER SPEED	AIR INLET DOOR POSITION	TEMPERATURE DOOR POSITION	MODE DOORS POSITION	DEFROSTER DOOR POSITION	COMPRESSOR	HTR-WATER SHUT-OFF VALVE	IS BLOWER DELAYED FOR ENGINE WATER WARMUP?
OFF	FIXED LOW	OUTSIDE AIR	VARIES – RESPONSIVE TO SENSORS	FORCED TO HEATER	SEALED	DOESN'T OPERATE	USUALLY OPEN – EXC. CLOSED AT MAX. A/C POSITION OF PROGRAMMER	YES*
VENT	5.0V – HTR 4.5V – A/C			A/C OR BI-LEVEL	DOOR WILL ASSUME "BLEED" POSITION AFTER 45 SECOND DELAY AND WILL DELIVER BLEED AIR TO W/S IF IN HEATER OR BI-LEVEL MODE			NO – BLOWER IS TURNED ON BY O'RIDE SW.
LO				EITHER HEATER, BI-LEVEL OR A/C DEPENDS ON PROGRAMMER POSITION		OPERATES ABOVE APPROX. 32°		YES*
AUTO.	VARIABLE BLOWER PROGRAM	RECIRCULATE AIR WHEN PROGRAMMER IS AT MAX. A/C - OTHERWISE OUTSIDE AIR						
HI	FIXED HI 13.5 V							
BI-LEVEL	VARIABLE BLOWER PROGRAM			BI-LEVEL			OPEN	
DEF	FIXED HI 13.5 V			FORCED TO HEATER	FULL OPEN TO W/S			NO – BLOWER IS TURNED ON BY O'RIDE SW.

*EXCEPT WHEN CAR INTERIOR IS WARM, IN WHICH CASE A SWITCH ON THE CONTROL HEAD TURNS BLOWER ON IMMEDIATELY, EVEN IF ENGINE IS COLD.

Fig. 1-26 System Operation At Various Lever Settings

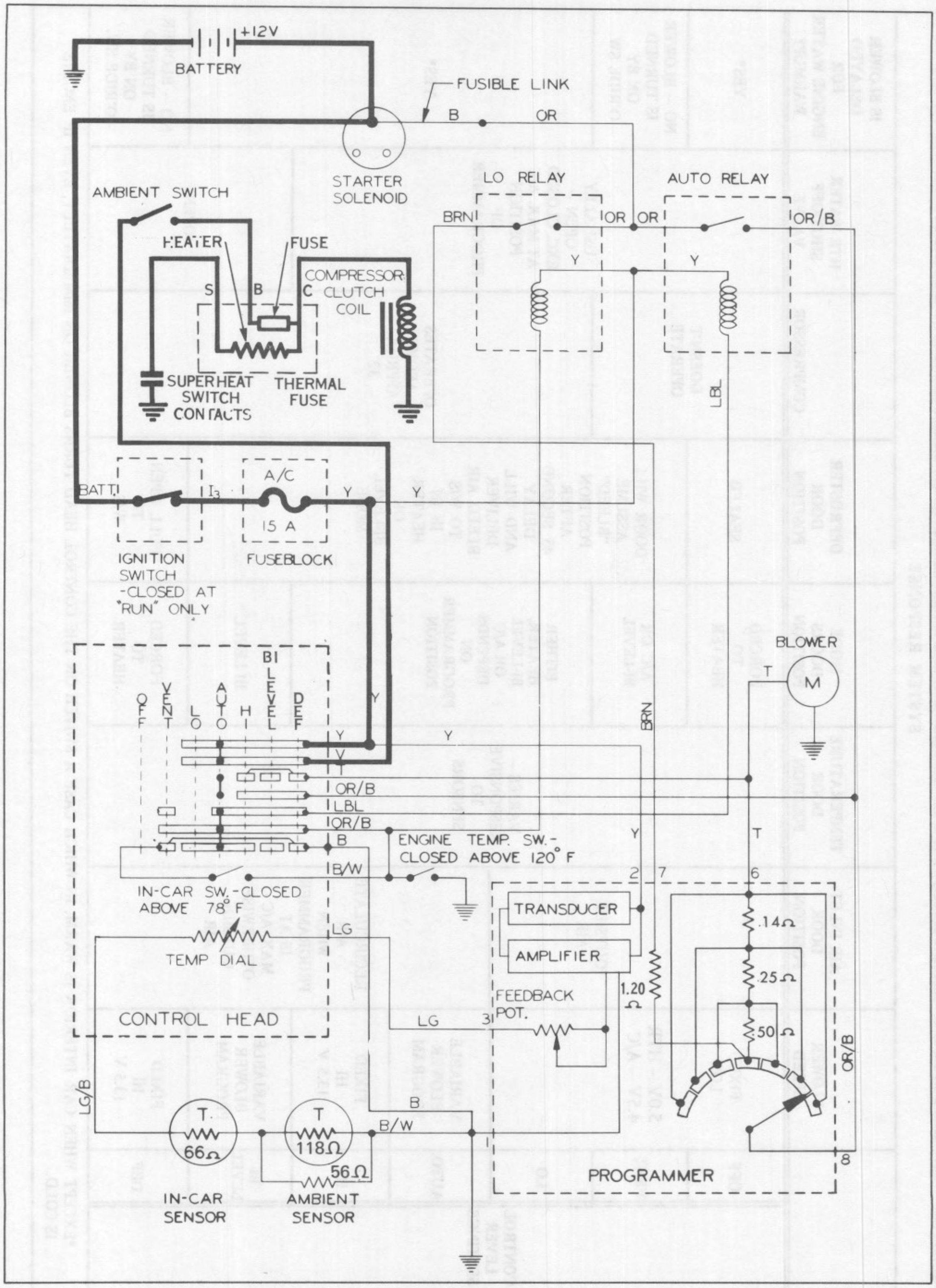


Fig. 1-27 Compressor Electrical Circuit

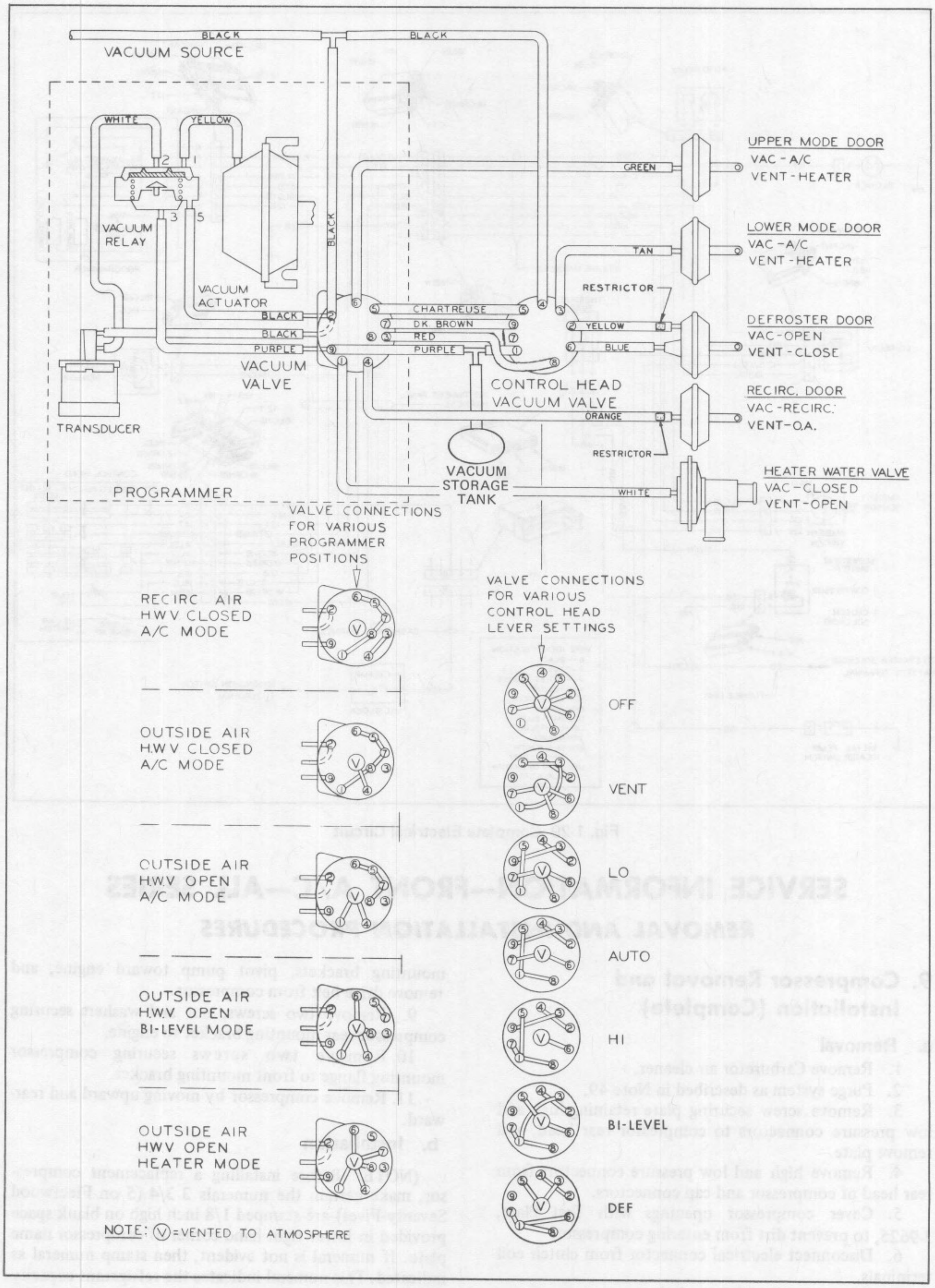


Fig. 1-28 Complete Vacuum Circuit

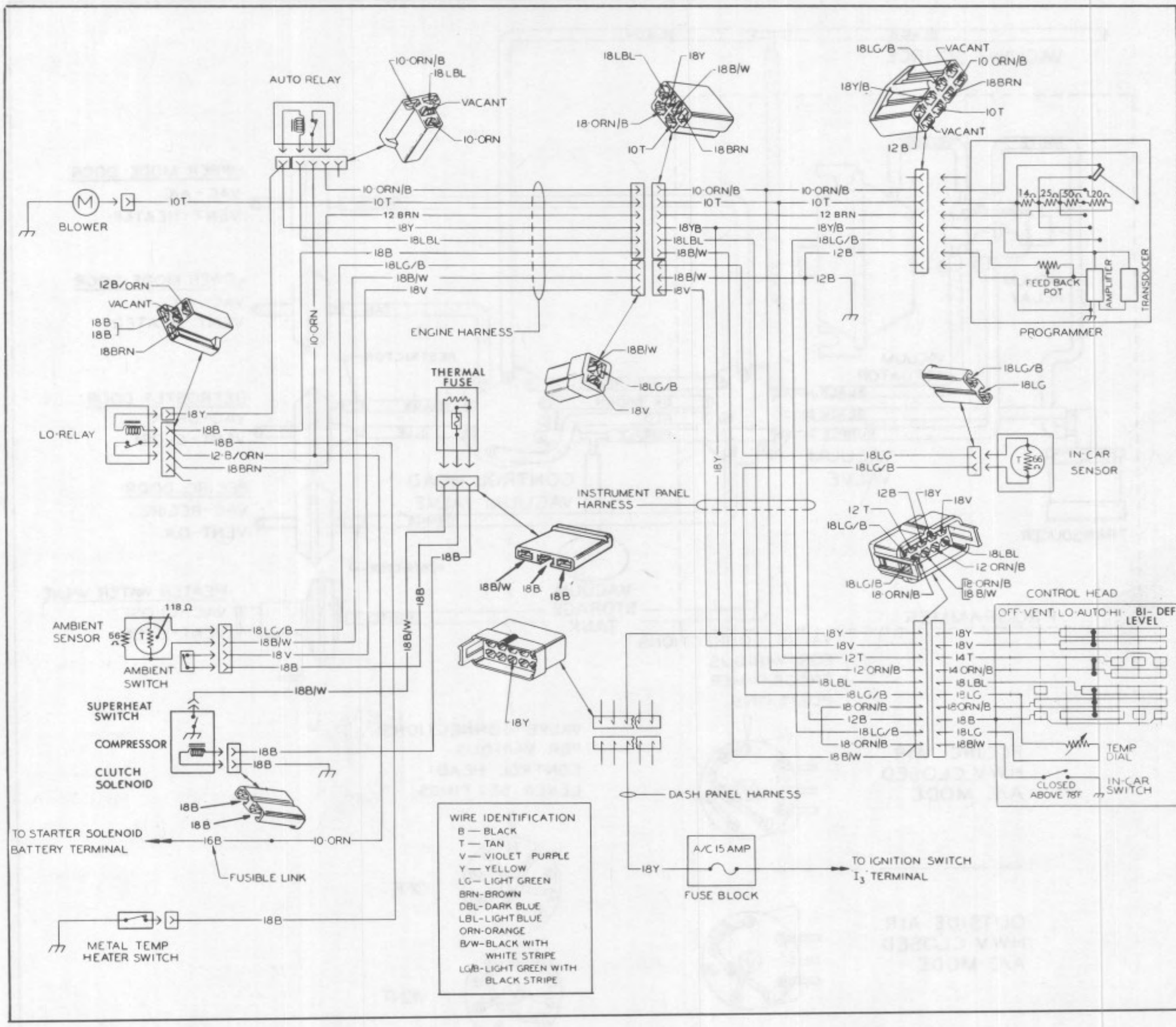


Fig. 1-29 Complete Electrical Circuit

SERVICE INFORMATION—FRONT A/C—ALL SERIES

REMOVAL AND INSTALLATION PROCEDURES

9. Compressor Removal and Installation (Complete)

a. Removal

1. Remove Carburetor air cleaner.
2. Purge system as described in Note 49.
3. Remove screw securing plate retaining high and low pressure connectors to compressor rear head, and remove plate.
4. Remove high and low pressure connectors from rear head of compressor and cap connectors.
5. Cover compressor openings with Test Plate, J-9625, to prevent dirt from entering compressor.
6. Disconnect electrical connector from clutch coil terminals.
7. Disconnect superheat switch.
8. Loosen bolts securing power steering pump to mounting brackets, pivot pump toward engine, and remove drive belt from compressor.
9. Remove two screws, nut and washers securing compressor rear mounting bracket to engine.
10. Remove two screws securing compressor mounting flange to front mounting bracket.
11. Remove compressor by moving upward and rearward.

b. Installation

(NOTE: Before installing a replacement compressor, make certain the numerals 3 3/4 (5 on Fleetwood Seventy-Fives) are stamped 1/8 inch high on blank space provided in lower right hand corner of compressor name plate. If numeral is not evident, then stamp numeral as indicated. This numeral indicates the refrigerant capacity and must be shown on all compressors as required by law in some states.)

1. Position compressor with rear mounting bracket aligned to engine, and loosely install two screws securing front mounting flange to front mounting bracket.
2. Loosely install two screws, nut and washers securing compressor rear mounting bracket to engine.
3. When compressor is properly positioned, tighten front mounting screws and then tighten screws and nut securing compressor to engine.
4. Install compressor drive belt on compressor and power steering pump and adjust as described in Section 6, Note 10.
5. Connect electrical connector to clutch coil terminals.
6. Connect superheat switch.
7. Remove Test Plate J-9527, and using new O-rings, position high and low pressure connectors to rear head and position retaining plate to connectors.

(NOTE: The O-rings in the compressor head should be oiled prior to placement in the cavity. Care should be taken not to damage these O-rings when installing the connectors.)

8. Install screw and washer securing retaining plate and pressure connectors to rear head of compressor.
9. Evacuate system as described in Note 49.
10. Charge system as described in Note 49. Leak test all compressor connections.

CAUTION: All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists. Loss of refrigerant prevents oil return to the compressor and operating compressor may damage it.

11. Install carburetor air cleaner.

10. Compressor Removal and Installation (Partial)

In order to perform certain engine operations it is necessary to move the compressor out of the way. This can be done without disconnecting any lines as follows:

a. Removal

1. Remove carburetor air cleaner.
2. Perform steps 6 through 10, Note 9.
3. Move complete assembly clear of working area, being careful not to kink hoses. Use rope or wire to hold compressor out of way.

b. Installation

1. Perform Steps 1-6, Note 9.
2. Install carburetor air cleaner.
3. Check system performance to assure no refrigerant was lost and system performs normally.

11. Condenser

a. Removal

1. Purge system as described in Note 49.
2. Remove two screws securing upper radiator mount bracket at each side of radiator cradle and remove two screws, one each side securing wheelhouse brace to bracket. Remove bracket.
3. Disconnect high pressure vapor line.
4. Remove clip securing liquid line to condenser frame.
5. Disconnect liquid line from condenser outlet pipe.
6. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.
7. Remove four clips, two each side, that fasten acromat to condenser frame.
8. Remove condenser from chassis.

b. Installation

1. Add refrigerant oil as described in Note 49.
2. With top of condenser tipped backwards, lower condenser into position until lower mounting brackets will go under upper rubber mounts. Tip condenser vertically and lower until all four mounting brackets are resting on rubber cushions.
3. Secure mounting brackets to rubber mounts with four nuts, two each side.
4. Install four clips, two each side holding acromat to condenser frame.
5. Connect high pressure vapor line to condenser using a new O-ring.
6. Connect liquid line from receiver to condenser at outlet pipe using a new O-ring.
7. Install clip securing liquid line to condenser frame.
8. Install two upper radiator mount brackets and secure to cradle with two screws. Secure wheelhouse brace to bracket with one screw at each side.
9. Evacuate system as described in Note 49.
10. Charge system with refrigerant as described in Note 49 and leak test condenser connections.

12. Desiccant Replacement

Replacement of the desiccant is not necessary unless one of the following conditions are encountered.

a. The system has been open for an extended period of time (such as after an accident).

b. There is evidence of moisture in the system.

c. A compressor failure requiring cleaning of the refrigeration system.

d. The VIR Assembly has been removed from the car for other service.

e. Other instances which your judgement indicates could cause moisture to enter the system.

13. V I R Assembly—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 49. While system is discharging, clean surface dirt from exterior of VIR assembly and from line connection areas. Blow any loose dirt away with an air hose.
2. When system is completely discharged (high and low sides), loosen and remove suction, liquid and liquid bleed line connections from VIR assembly.

CAUTION: All line connections and VIR openings must be plugged or sealed immediately to prevent entry of dirt and moisture into system.

3. Loosen evaporator inlet and outlet connection nuts at VIR assembly.

4. Remove VIR mounting clamp (1 screw) from liquid receiver and carefully slide VIR assembly off of evaporator outlet tube first and then off of evaporator inlet tube. Plug or seal all openings.

(NOTE: Whenever VIR assembly is removed from car, drier desiccant should be changed. Refer to Note 12 for desiccant replacement policy).

b. Installation

1. Before installing VIR assembly, obtain set of new line connection O-rings. Lubricate all new O-rings liberally with clean refrigerant oil.

CAUTION: When making connections use care to avoid nicking O-rings or cross threading connection threads.

2. Remove plugs from evaporator inlet and outlet tubes and corresponding VIR assembly openings. Install new O-rings and position VIR assembly to evaporator inlet tube first and then to outlet tubes, Fig. 1-30. When VIR assembly is in proper position, install mounting clamp.

3. Tighten evaporator inlet connection to 15-20 ft. lbs. torque and evaporator outlet connection to 28-33 ft. lbs. torque.

4. Remove plugs from liquid bleed line and corresponding VIR assembly opening, install new O-ring and connect line to VIR assembly. Tighten connection to 5-7 ft. lbs. torque.

5. Remove plugs from liquid line and corresponding VIR assembly opening, install new O-ring and connect line. Tighten connection to 11-13 ft. lbs. torque.

6. Remove plugs from suction line and corresponding VIR assembly opening, install new O-ring and connect line to VIR assembly. Tighten connection to 28-33 ft. lbs. torque.

7. Evacuate, leak check and charge refrigerant system, as described in Note 49.

14. Drier Desiccant—Removal and Installation

a. Removal

(NOTE: Refer to Note 12 for Desiccant Replacement Policy.)

1. Discharge refrigeration system as described in Note 49. While system is discharging, clean surface dirt from exterior of VIR assembly. Blow any loose dirt away with an air hose.

2. When system is completely discharged, loosen receiver shell to valve housing retaining screws approximately three turns.

WARNING: FOR PERSONAL SAFETY, DO NOT REMOVE SCREWS ENTIRELY UNTIL INSTRUCTED TO DO SO.

3. Remove VIR mounting screw and bracket from receiver.

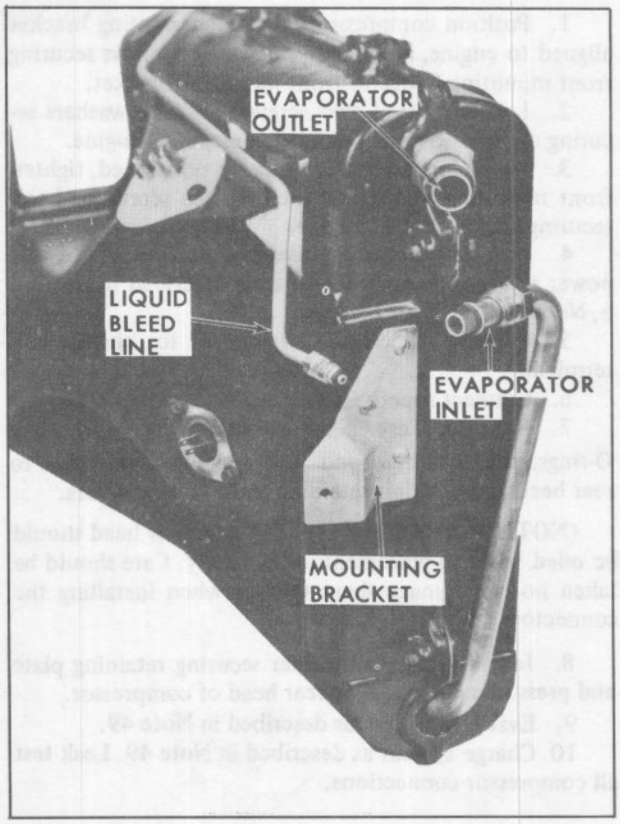


Fig. 1-30 Evaporator Connections

4. Hold VIR valve housing and push on lower end of receiver to break seal between receiver and valve housing. If receiver sticks and is hard to cock to one side, carefully pry between receiver mounting flange and condenser line connection with a flat-blade screwdriver to free receiver.

5. Remove (6) mounting screws and receiver by lowering downward to clear liquid pick-tube and filter screen. Discard bag of drier desiccant and valve housing-to-receiver O-ring.

6. Drain, measure and discard any oil present in receiver. Remove pick-up tube filter screen. Wash filter screen and interior of receiver shell with clean solvent and blow dry with air hose.

(NOTE: Recommended solvents in order of preference are trichlorethylene, naphtha, stoddard solvent and kerosene.)

b. Installation

1. Lubricate new valve housing to receiver O-ring with clean refrigerant oil and install in groove on valve housing.

2. Add film of clean refrigerant oil at inner top surface of receiver to aid in assembly. Reassemble filter screen to pick-up tube (be sure screen is all the way onto tube).

3. Add to receiver one ounce of clean refrigerant oil, amount drained from receiver in Step 6 of part a above plus amount lost during discharge.

4. Add new bag of drier desiccant to receiver and assemble receiver to valve housing. Tighten receiver mounting screws to 10 ft. lbs.

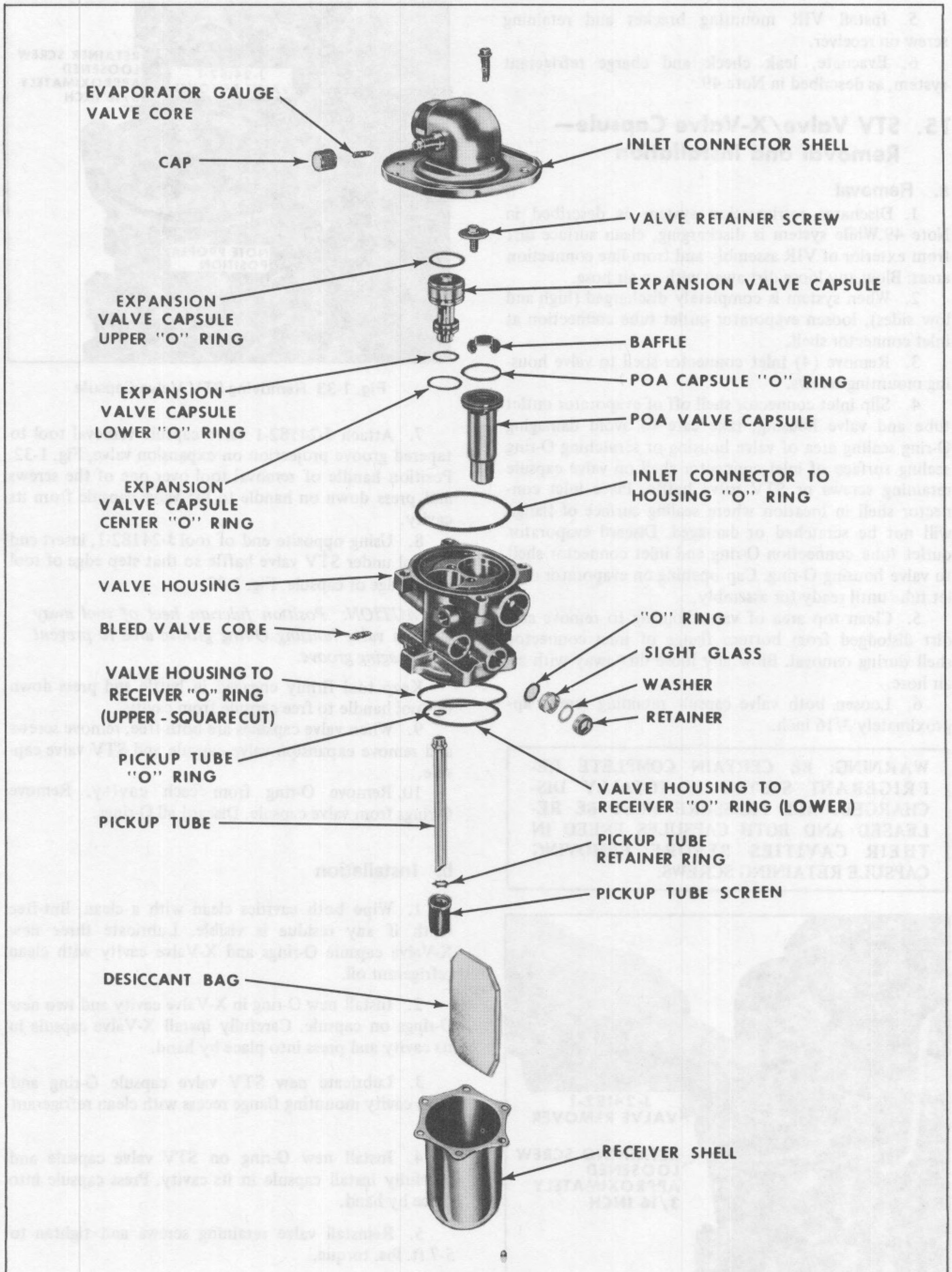


Fig. 1-31 VIR Assembly—Exploded View

5. Install VIR mounting bracket and retaining screw on receiver.

6. Evacuate, leak check and charge refrigerant system, as described in Note 49.

15. STV Valve/X-Valve Capsule—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 49.While system is discharging, clean surface dirt from exterior of VIR assembly and from line connection areas. Blow any loose dirt away with an air hose.

2. When system is completely discharged (high and low sides), loosen evaporator outlet tube connection at inlet connector shell.

3. Remove (4) inlet connector shell to valve housing mounting screws.

4. Slip inlet connector shell off of evaporator outlet tube and valve housing; take care to avoid damaging O-ring sealing area of valve housing or scratching O-ring sealing surface of inlet connector shell on valve capsule retaining screws or STV valve baffle. Place inlet connector shell in location where sealing surface of flange will not be scratched or damaged. Discard evaporator outlet tube connection O-ring and inlet connector shell to valve housing O-ring. Cap opening on evaporator outlet tube until ready for assembly.

5. Clean top area of valve housing to remove any dirt dislodged from bottom flange of inlet connector shell during removal. Blow any loose dirt away with an air hose.

6. Loosen both valve capsule retaining screws approximately 3/16 inch.

WARNING: BE CERTAIN COMPLETE REFRIGERANT SYSTEM IS TOTALLY DISCHARGED. ALL PRESSURE MUST BE RELEASED AND BOTH CAPSULES FREED IN THEIR CAVITIES BEFORE REMOVING CAPSULE RETAINING SCREWS.

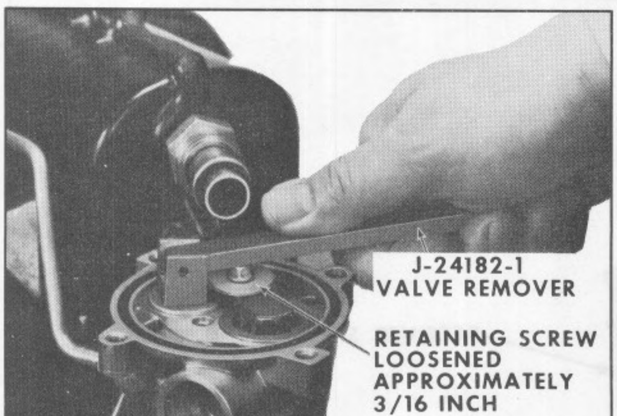


Fig. 1-32 Removing Expansion Valve Capsule

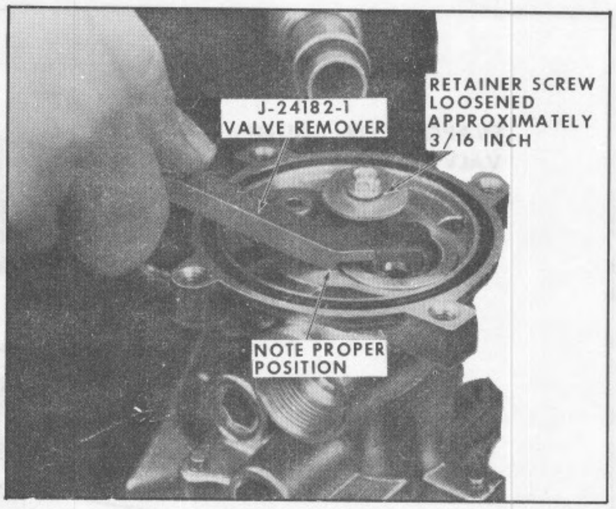


Fig. 1-33 Removing STV Valve Capsule

7. Attach J-24182-1 valve capsule removal tool to tapered groove projection on expansion valve, Fig. 1-32. Position handle of removal tool over one of the screws and press down on handle to lift valve capsule from its cavity.

8. Using opposite end of tool J-24182-1, insert end of tool under STV valve baffle so that step edge of tool clears edge of capsule, Fig. 1-33.

CAUTION: Position fulcrum heel of tool away from valve housing O-ring groove area to prevent damaging groove.

Keep tool firmly engaged in baffle and press down on tool handle to free capsule from cavity.

9. When valve capsules are both free, remove screws and remove expansion valve capsule and STV valve capsule.

10. Remove O-ring from each cavity. Remove O-rings from valve capsule. Discard all O-rings.

b. Installation

1. Wipe both cavities clean with a clean, lint-free cloth if any residue is visible. Lubricate three new X-Valve capsule O-rings and X-Valve cavity with clean refrigerant oil.

2. Install new O-ring in X-Valve cavity and two new O-rings on capsule. Carefully install X-Valve capsule in its cavity and press into place by hand.

3. Lubricate new STV valve capsule O-ring and valve cavity mounting flange recess with clean refrigerant oil.

4. Install new O-ring on STV valve capsule and carefully install capsule in its cavity. Press capsule into place by hand.

5. Reinstall valve retaining screws and tighten to 5-7 ft. lbs. torque.

6. Clean entire bottom flange surface of inlet connector shell. Inspect O-ring sealing area of flange for any scratches that could result in a leak.

7. Lubricate new inlet connector shell to valve housing O-ring and new evaporator outlet tube connection O-ring with clean refrigerant oil. Install O-rings and carefully position inlet connector shell onto evaporator outlet tube. Start thread of connection nut into inlet connector shell but do not tighten.

CAUTION: Use care in moving inlet connector shell across top of valve housing to prevent scratching sealing surface on flange.

8. Position inlet connector shell over valve housing, install mounting screws and tighten screws to 10 ft. lbs. torque.

9. Tighten evaporator outlet tube connection nut to 28-33 ft. lbs. torque.

10. Evacuate, leak check and charge refrigerant system, as described in Note 49.

16. Sight Glass—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 49. While system is discharging, clean surface dirt from exterior of VIR assembly and from line connection areas. Make certain sight glass area is clean. Blow any loose dirt away with an air hose.

2. When system is completely discharged (high and low sides), remove sight glass retaining nut by using 7/16" male hex drive tool or allen wrench.

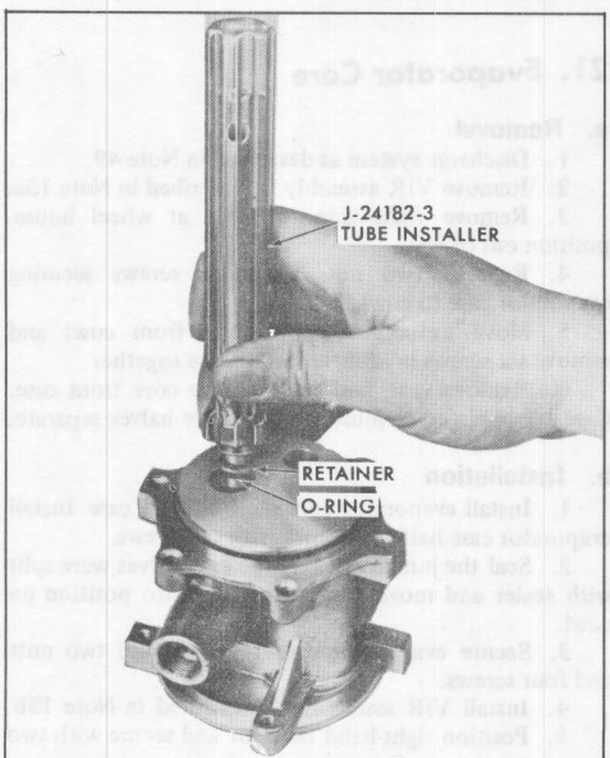


Fig. 1-34 Installing Pick Up Tube.

3. Hold finger in sight glass opening to lightly hold glass. Slightly pressurize system with refrigerant vapor to force sight glass and thrust washer out of opening and against finger.

(NOTE: It may be necessary to shift finger pressure from side to side to guide sight glass out of opening but only a very minimum refrigerant pressure is necessary to expel sight glass.)

4. Remove sight glass O-ring. Discard all sight glass parts (glass, O-ring, thrust washer and nut) and obtain sight glass parts kit for re-assembly.

b. Installation

1. Coat new O-ring, sight glass, nylon thrust washer and retaining nut with clean refrigerant oil and install parts in that order into VIR assembly being careful to prevent dirt getting on parts. Tighten retaining nut to 20-25 in. lbs. torque.

2. Evacuate, leak check and charge refrigerant system as directed in Note 49.

17. Pickup Tube

Complete disassembly of the VIR assembly will require the use of J-24182-3 to install the pickup tube retainer. Refer to Fig. 1-34 for this operation.

18. Liquid Bleed Valve Core/ Evaporator Gage Valve Core—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 49.

2. Remove cap from valve connection.

3. Using J-24182-2 valve core remover and installer, remove and discard valve core, Fig. 1-35.

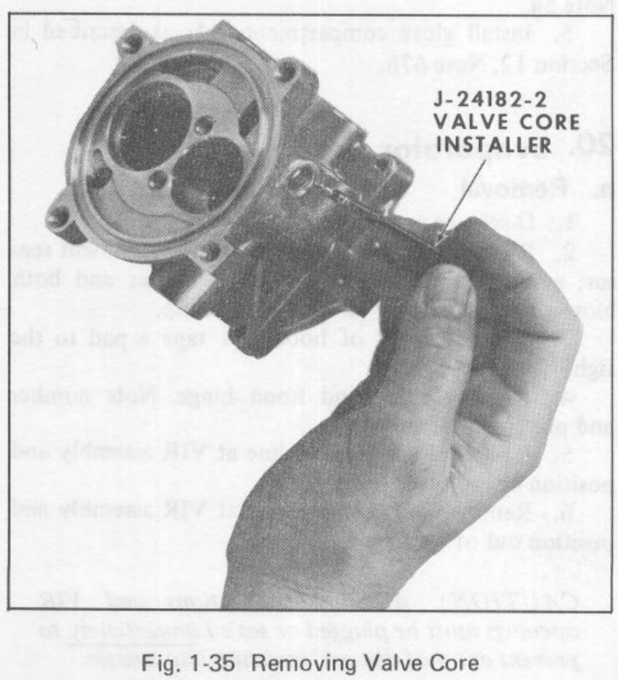


Fig. 1-35 Removing Valve Core

b. Installation

1. Install new core by turning core inward until core threads just start to tighten. Fig. 1-35. Note position of J-24182-2 and tighten core an additional one-half turn (180° rotation of tool). This will provide an approximate torque of 24-36 ounce inches.

CAUTION: Evaporator gage fitting and liquid bleed valve use different valve cores; always make certain that proper core is used. Evaporator gage core is blue in color while bleed core is gold or red in color.

2. Evacuate, leak check and charge refrigerant system as described in Note 49.
3. Install cap on valve connection.

19. Programmer

a. Removal

1. Open glove compartment door and remove compartment liner as described in Section 12, Note 67a.
2. Disconnect vacuum harness from programmer vacuum valve.
3. Disconnect electrical harness from programmer.
4. Disconnect door link from programmer output shaft.
5. Remove three screws securing programmer to heater case and remove programmer.

b. Installation

1. Position programmer to heater case - secure with three screws.
2. Connect electrical connector to programmer.
3. Connect vacuum harness to programmer vacuum valve. Secure harness with clips on pins of valve.
4. Install door link and adjust as described in Note 54.
5. Install glove compartment liner as described in Section 12, Note 67b.

20. Evaporator Case

a. Removal

1. Discharge system as described in Note 49.
2. Remove electrical connections from ambient sensor, ambient switch, low refrigerant limiter and both blower relays. Remove blower ground wire.
3. Support front of hood and tape a pad to the right-hand rear corner.
4. Remove right-hand hood hinge. Note number and placement of shims.
5. Remove high pressure line at VIR assembly and position out of way.
6. Remove low pressure line at VIR assembly and position out of way.

CAUTION: All line connections and VIR openings must be plugged or sealed immediately to prevent entry of dirt and moisture into system.

7. Remove right-hand tie strut at wheel house and position out of way.
8. Remove two nuts and four screws securing evaporator case to cowl.
9. Remove three screws holding evaporator case to air inlet and separate evaporator case from air inlet. Gasket must be cut apart at air inlet-to-evaporator case joint.
10. Remove vacuum hose from recirc. door actuator. Remove evaporator case and air inlet.

b. Installation

1. Position air inlet near cowl and connect vacuum hose to recirc. door actuator. Install sealer any place that gasket has separated.
2. Position evaporator case near cowl and secure to air inlet with three screws.
3. Secure evaporator case to cowl with four screws and two nuts.
4. Connect high pressure line to VIR assembly using a new O-ring.
5. Connect low pressure line to VIR assembly using a new O-ring.
6. Install right-hand tie strut to wheel house.
7. Install right-hand hood hinge.

(NOTE: Install shims as removed.)

8. Remove hood support and pad from corner of hood.
9. Make electrical connections to ambient sensor, ambient switch, low refrigerant limiter and blower relays. Install blower ground wire.
10. Evacuate and charge refrigeration system as described in Note 49 and leak test all connections.

21. Evaporator Core

a. Removal

1. Discharge system as described in Note 49.
2. Remove VIR assembly as described in Note 13a.
3. Remove right side tie strut at wheel house, position out of way.
4. Remove two nuts and four screws securing evaporator case to cowl.
5. Move evaporator case away from cowl and remove six screws holding halves of case together.
6. Remove case half and remove core from case. Case to cowl gasket must be cut where halves separate.

b. Installation

1. Install evaporator core in position in case. Install evaporator case half and secure with six screws.
2. Seal the junction where the case halves were split with sealer and move evaporator case into position on cowl.
3. Secure evaporator case to cowl with two nuts and four screws.
4. Install VIR assembly as described in Note 13b.
5. Position right-hand tie strut and secure with two nuts.
6. Evacuate and charge refrigeration system as described in Note 49 and leak test all connections.

22. Blower Motor

a. Removal

1. Disconnect negative battery cable.
2. Remove rubber cooling hose from nipple and blower motor.
3. Disconnect electrical connector at lead to motor.
4. Remove six screws securing blower to case and remove blower.

b. Installation

1. Install ground wire and capacitor to blower flange screw at 5 o'clock position.
2. Place a bead of sealer around opening where blower will contact case.
3. Guide blower motor against cowl and place on locating dowel.
4. Install five screws securing blower to case.
5. Connect electrical connector at lead to motor.
6. Install cooling hose on motor and nipple.

23. Heater Case

a Removal

1. Drain radiator.
2. Remove hoses from heater core nipples and plug nipples to prevent spilling coolant remaining in core.
3. Remove instrument panel pad as described in Section 12, Note 32a.
4. On cars with Air Cushion Restraint System, perform following operations:

   a. Remove Knee Restraint as described in Section 12, Note 74a.

   b. Remove right hand lower trim cover as described in Section 12, Note 80a.

   c. Remove Air Cushion Assembly as described in A.C.R.S. service manual.
5. Remove center A/C outlet support and connector from position between cowl and horizontal support, Fig. 1-36.
6. Remove left A/C outlet hose from A/C distributor.
7. Remove center support and associated braces as shown in Fig. 1-36.
8. Remove two screws securing A/C distributor to heater case and remove distributor, Fig. 1-36.
9. Remove one screw securing defroster nozzle and remove nozzle.
10. On cars without Air Cushion Restraint, remove glove compartment liner as described in Section 12, Note 67a
11. Remove vacuum and electrical connectors from programmer.
12. Disconnect vacuum hose from recirc door actuator, defroster door actuator, mode door actuators and position vacuum harness out of way, Fig. 1-37.
13. Disconnect aspirator hose from in-car sensor.
14. Remove three nuts and one screw securing heater case to cowl on engine side of cowl, Fig. 1-8.

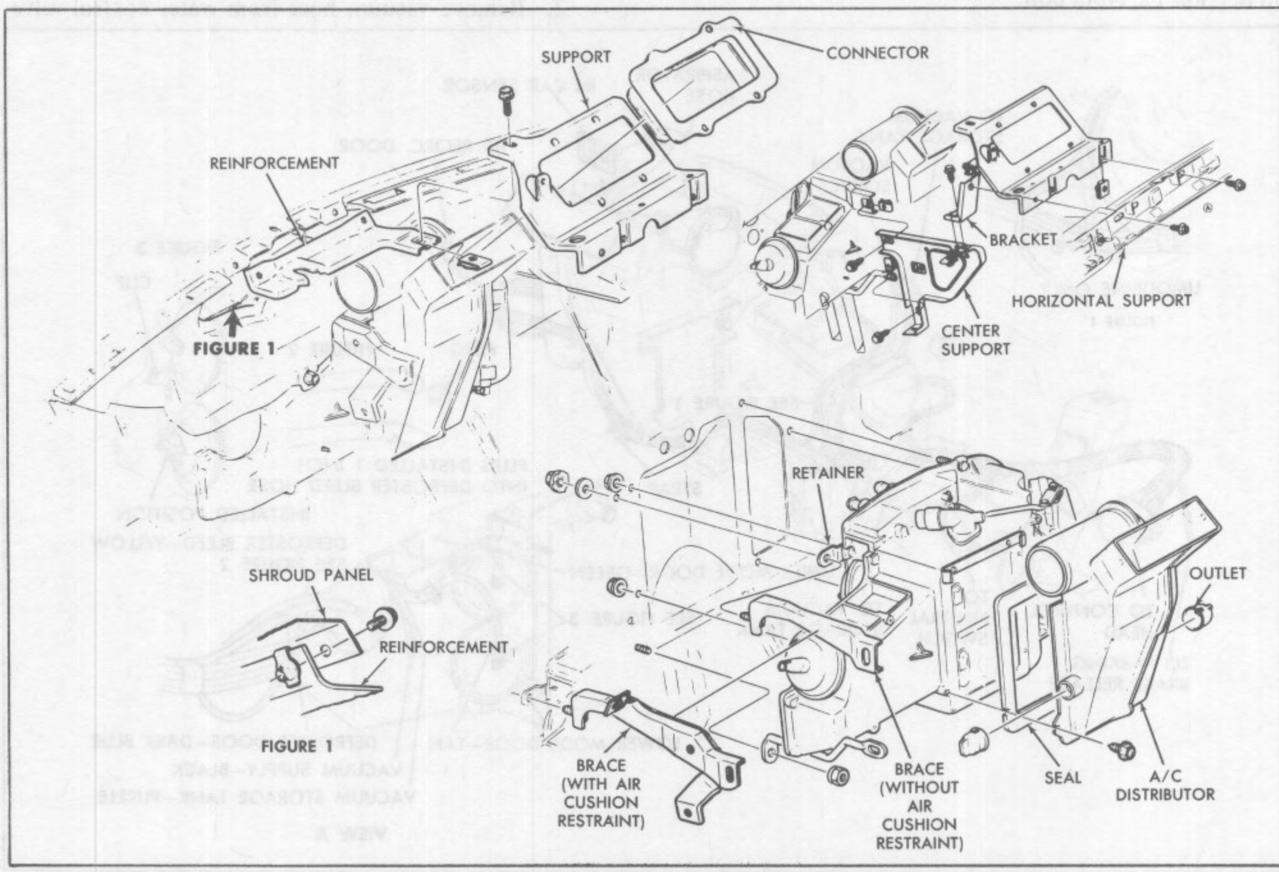


Fig. 1-36 Heater Case Assembly

15. Remove heater case from position under instrument panel.

b. Installation

1. Position heater case to cowl as shown in Fig. 1-8.
2. Screw heater case to cowl with three nuts and one screw.
3. Remove plugs from heater core nipples and install heater hoses.
4. Refill cooling system.
5. Connect vacuum hoses to recirc door actuator, defroster door actuator, mode door actuators and programmer vacuum valve, Fig. 1-37. Position vacuum harness as shown in Fig. 1-37.
6. Connect programmer electrical connector.
7. Connect in-car sensor aspirator hose, Fig. 1-19.
8. Position defroster nozzle and secure with one screw.
9. Position A/C distributor to heater case and secure with two screws, Fig. 1-36.
10. Install left hand A/C outlet hose to A/C distributor.
11. Install center support and associated braces as shown in Fig. 1-36.
12. Position center A/C outlet support and secure with three screws. Install outlet connector.
13. On cars equipped with Air Cushion Restraint system, perform the following operations:
    a. Install Air Cushion assembly as described in A.C.R.S. service manual.
    b. Install right hand lower trim cover as described in Section 12, Note 80b.
    c. Install Knee Restraint as described in Section 12, Note 74b.
14. On cars without Air Cushion Restraint install glove compartment liner.
15. Install instrument panel pad as described in Section 12, Note 32b.
16. Check A/C controls for proper operation.

24. Heater Core

a. Removal

1. Remove heater case as described in Note 23a.
2. Remove rubber seal from around core water nipples.
3. Remove screw and clip from beneath seal.
4. Remove two screws and clip from opposite end of core and remove core from position in case.

b. Installation

1. Locate heater core in position in heater case.
2. Secure bottom of core with clip and two screws.
3. Secure top of core with clip and screw.
4. Install rubber seal over water nipples.
5. Install heater case as described in Note 23b.

25. Water Control Valve

(NOTE: The thermal vacuum valve is installed on 75 Series rear units only and is serviced with the water control valve as an assembly.)

a. Removal

1. Clamp off valve inlet and outlet water hoses.
2. Remove vacuum hose from water control valve.

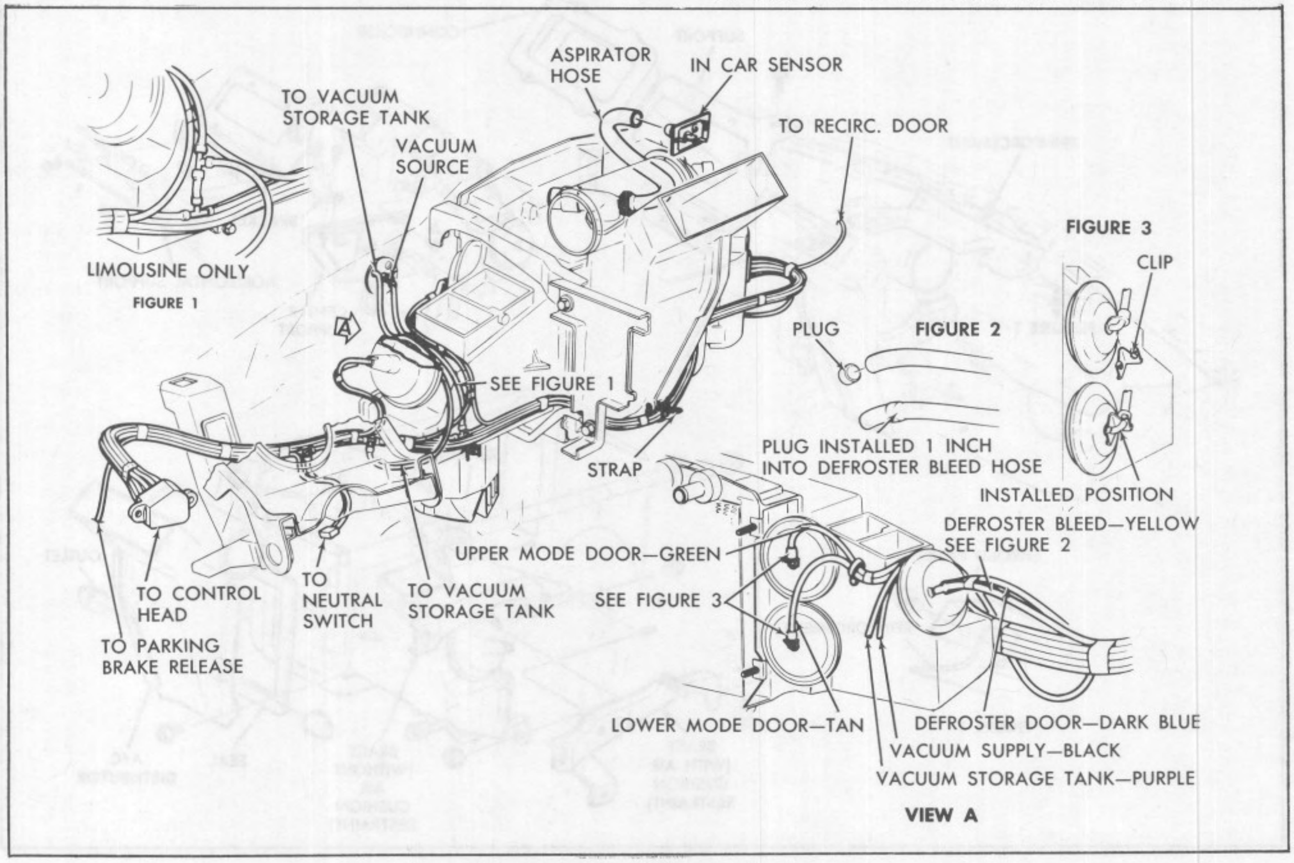


Fig. 1-37 Heater Case Vacuum Connections

3. On 75 Series rear units, remove vacuum hoses from thermal vacuum valve.

4. Remove clamps securing hoses to valve, and remove valve from hoses.

b. Installation

1. Install water valve on inlet and outlet hoses and install clamps.
2. Remove clamps from hoses.
3. On all but 75 Series rear units, install white vacuum hose at water control valve.
4. On 75 Series rear units, install red vacuum hose at water control valve. Install yellow and purple vacuum hoses on thermal vacuum valve so yellow hose connects to vacuum nipple closest to water outlet fitting.
5. Replace any coolant lost.

26. Air Conditioning Outlets

The procedures for removing and installing the outlets are described in Section 12, Note 30.

27. In-Car Sensor

The procedure for removing and installing the in–car sensor is described in Section 12, Note 43.

28. Automatic Climate Control Air Conditioner Control Panel

The procedure for removing and installing the control panel is described in Section 12, Note 42.

29. Air Conditioning Control Panel Disassembly and Assembly

The control panel must be removed as described in Section 12, Note 42a to perform any of the following procedures.

a. Circuit Board Removal

1. Remove one screw securing wire harness clip to control head base plate.
2. Remove two green wires from temperature dial rheostat.
3. Remove three screws on bottom of base plate securing circuit board to base plate.
4. Move control lever to "OFF" position and remove circuit board by sliding out from under control lever.

b. Circuit Board Installation

1. Move control lever to "DEF" position and feed circuit board connector and wires through base plate from bottom.

CAUTION: This procedure is important to avoid damage to the wiper contacts on bottom of control lever.

2. Work circuit board into position and secure to base plate with three screws.
3. Working on top side of control head, connect two green wires to temperature dial rheostat, Fig. 1-20.
4. Secure harness clip to base plate with one screw, Fig. 1-20.

c. Temperature Dial Rheostat Removal

1. Disconnect two green leads from rheostat terminals.
2. Remove two screws securing rheostat bracket to mounting plate and remove rheostat.

d. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and install two screws securing rheostat bracket to mounting plate.
2. Connect two green wires to rheostat terminal.
3. After installing control panel on car, adjust temperature dial as indicated in Note 53.

e. Control Head Vacuum Valve Removal

1. Loosen two screws securing control vacuum valve to control head and remove valve.

f. Control Vacuum Valve Installation

1. Position control vacuum valve on control head so that pin engages lever arm.
2. Secure with two screws.

30. Superheat Switch

a. Removal

1. Completely discharge air conditioning system as described in Note 49.
2. Remove carburetor air cleaner and remove wire from superheat switch.
3. Loosen one screw securing plate retaining high and low pressure connectors to compressor rear head. Remove plate and connectors.
4. Loosen power steering pump to relieve tension on compressor pulley.
5. Remove four screws and one nut securing compressor to engine and prop-up rear of compressor.
6. Remove superheat switch retainer ring using snap ring pliers, J-5403.
7. Remove superheat switch from rear head by pulling at terminal housing groove with a pair of pliers.
8. Remove "O" ring from switch cavity in rear head. Use Oil Pick-Up Tube Remover, J-5139, or a wire with a hook on the end.
9. Recheck superheat switch for closed contacts. See superheat switch check in diagnosis section on page 1-27. Replace as necessary.

b. Installation

1. Check cavity and "O" ring groove in rear head for dirt or foreign material and be sure area is clean before installing "O" ring. Lubricate "O" ring liberally with 525 viscosity oil, and install in groove of cavity in rear head.
2. Lubricate housing of superheat switch with 525 viscosity oil and insert switch carefully into switch cavity until switch bottoms.
3. Using Snap Ring Pliers, J-5403, install superheat switch retainer ring with high point of the curved sides next to the switch housing, Fig. 1-19. Be sure the retainer ring is properly seated in the snap ring groove.
4. Check for electrical continuity between switch housing and rear head. Also check for continuity between terminal and switch housing to be sure the contacts are open.

5. Return compressor to position on engine and secure with four screws and one nut.

6. Adjust compressor belt tension as described in Section 6, Note 10.

7. Position high and low pressure connectors to rear head and secure with plate and screw.

8. Connect wire to superheat switch and install carburetor air cleaner.

9. Evacuate and recharge system with refrigerant, according to the following special charging procedure.

CAUTION: To prevent the possibility of "blowing" the thermal fuse during charging of the system, disconnect the superheat switch and short across terminals "B" and "C" of the wiring harness connector.

a. Evacuate, recharge and leak check entire A/C system according to procedure described in Note 49 Repair any leaks, check and add oil as required for proper operation of system.

b. When system is operating normally, reconnect thermal fuse.

COMPRESSOR OVERHAUL

31. Compressor Service

When servicing the compressor, remove only the necessary components that preliminary diagnosis indicates are in need of service. Refer to Fig. 1-65 for information relative to parts nomenclature and location.

Some service operations can be performed without disturbing the internal mechanism assembly or completely removing the compressor from the car. Among them are replacement of the clutch plate and hub assembly, the pulley and bearing assembly, and pulley bearing.

The clutch coil and housing assembly also may be replaced without completely removing the compressor, after clutch and pulley parts have been removed. It is not necessary to disturb the shaft seal.

The shaft seal assembly can be replaced by partially removing the compressor from the car and removing the clutch plate and hub assembly to gain access to the seal. A complete kit of shaft seal parts is available for field replacement.

Removal and installation of external compressor components and disassembly and assembly of internal components must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Parts Tray, J-9402, should be used for all parts being removed as well as for replacement parts.

Although certain service operations can be performed without completely removing the compressor from the car, the operations described herein are based on bench overhaul with the compressor removed from the car. They have been prepared in sequence in order of accessibility of the components.

When a compressor is removed from the car for servicing, the amount of oil remaining in the compressor should be drained and measured. This oil should then be discarded and new oil added to the compressor as described in Note 49.

32. Compressor Clutch Plate and Hub Assembly

a. Removal

1. Place Holding Fixture, J-9396, in a vise, and
2. Keep clutch hub from turning with Clutch Hub Holding Tool, J-9403, and remove locknut from end of shaft using Thin Wall Socket, J-9399, Fig. 1-38.
3. Thread Clutch Plate and Hub Assembly remover, J-9401, into hub. Hold body of tool with a wrench and tighten center screw to remove clutch plate and hub assembly, Fig. 1-39.
4. Remove square drive key from shaft.

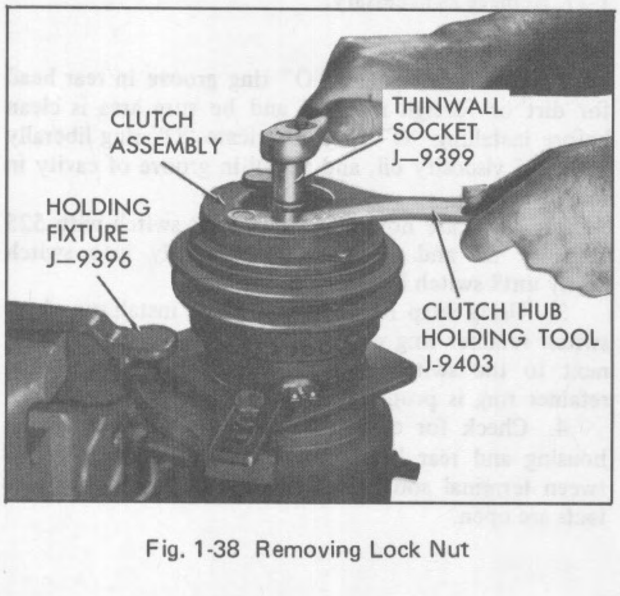


Fig. 1-38 Removing Lock Nut

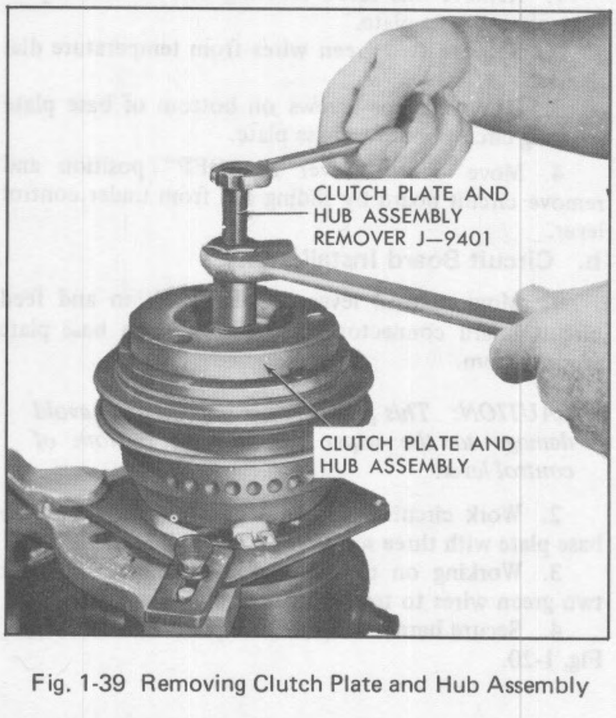


Fig. 1-39 Removing Clutch Plate and Hub Assembly

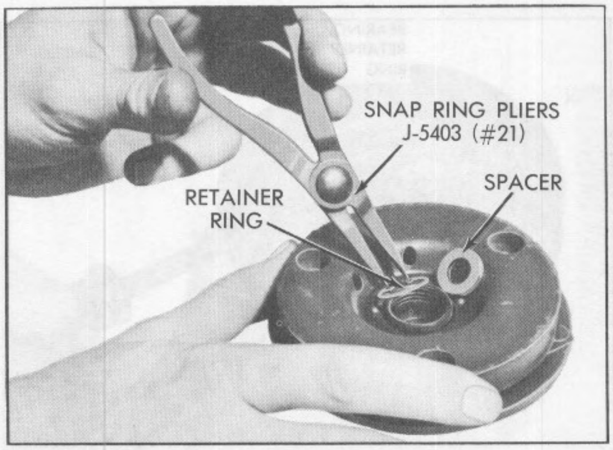


Fig. 1-40 Removing Hub Retainer Ring And Spacer

5. Remove hub retainer ring using Snap Ring Pliers, J-5403 (#21), and then remove hub spacer, Fig. 1-40.

b. Installation

1. Install square drive key on shaft, allowing it to project approximately 3/16 inch out of keyway.

2. Wipe frictional surface of clutch plate and pulley clean.

3. Place clutch plate and hub assembly on shaft, aligning shaft key with keyway in hub.

CAUTION: To avoid internal damage to compressor, do not drive or pound on hub or shaft. This could mis-position axial plate on shaft, resulting in damage to compressor.

4. Place Spacer, J-9480-2, on hub, Fig. 1-41. Insert end of Clutch Plate and Hub Assembly Installer, J-9480-1, through spacer and thread tool onto end of shaft.

5. Hold hex portion of tool body with a wrench and tighten center screw several turns to press hub partially on shaft, Fig. 1-41.

6. Remove Clutch Plate and Hub Assembly Installer and Spacer. Check alignment of drive key with keyway in shaft. If alignment is correct, replace installer tools

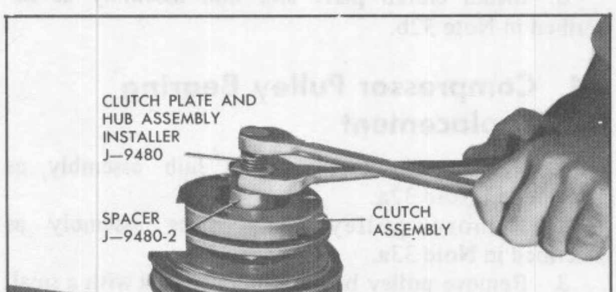


Fig. 1-41 Installing Clutch Plate and Hub Assembly

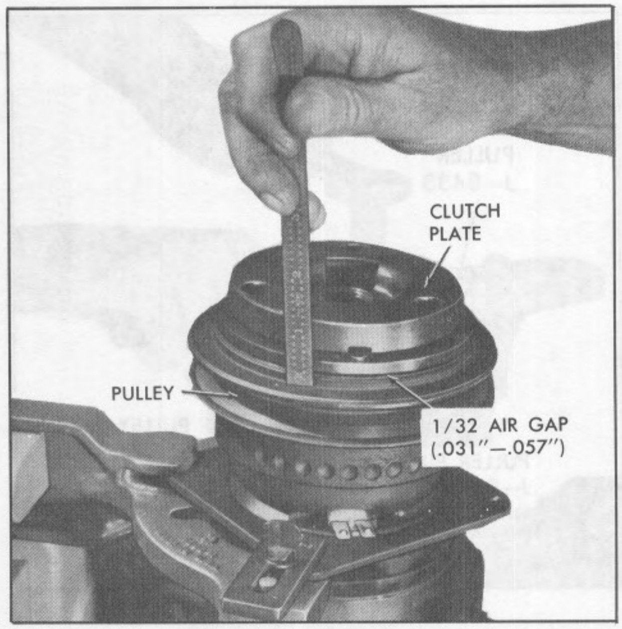


Fig. 1-42 Checking Air Gap

and continue to press hub onto shaft until there is approximately a 3/32 inch (.093 inch) air gap between frictional surfaces of pulley and clutch plate.

(NOTE: A zero thrust race is 3/32 inch thick and can be used as a gage between these frictional surfaces.)

7. Remove Installer, J-9480, and Spacer, J-9480-2.

8. Install hub spacer.

9. Using Snap Ring Pliers, J-5403 (#21), install hub retainer ring with flat side of ring facing spacer.

10. Install a new shaft locknut with small diameter boss of nut against hub spacer, using special Thin Wall Socket J-9399, Fig. 1-38. Hold clutch hub with Clutch Hub Holding Tool, J-9403, and tighten nut to 15 foot-pounds torque, using a 0-25 foot pounds torque wrench. Air gap between frictional surfaces of pulley and clutch plate should now be approximately 1/32 inch (.031 inch to .057 inch), Fig. 1-42.

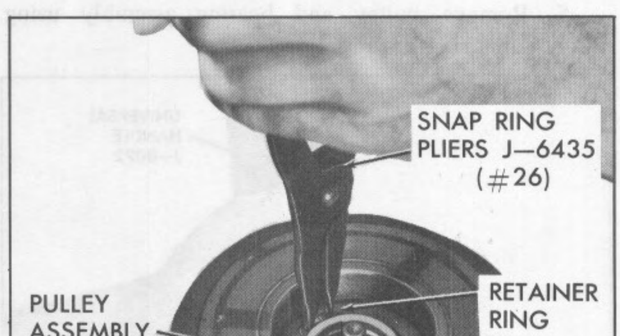


Fig. 1-43 Removing Pulley Retainer Ring

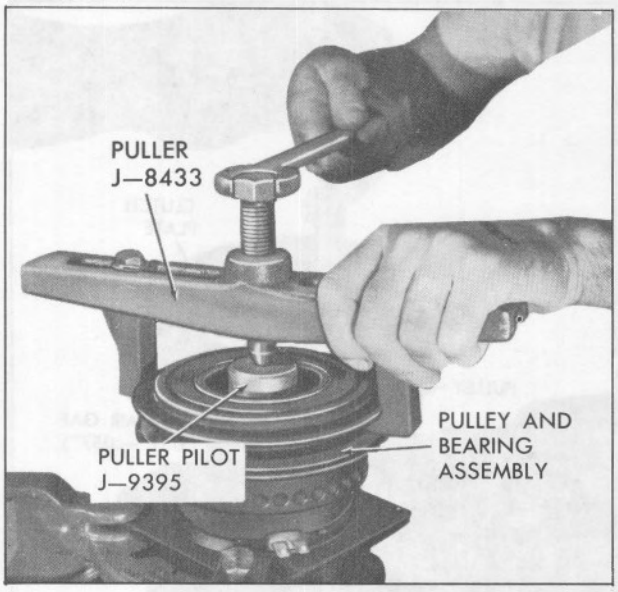


Fig. 1-44 Removing Pulley and Bearing Assembly

33. Compressor Pulley and Bearing Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 32a.

2. Remove pulley retainer ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-43.

3. Pry out absorbent sleeve retainer, and remove absorbent sleeve from compressor neck.

4. Place Puller Pilot, J-9395, over end of compressor shaft.

CAUTION: It is important that Puller Pilot, J-9395, be used to prevent internal damage to compressor when removing pulley. Under no circumstances should Puller be used directly against drilled end of shaft.

5. Remove pulley and bearing assembly using Pulley Puller, J-8433, Fig. 1-44.

Fig. 1-45 Installing Pulley and Bearing Assembly

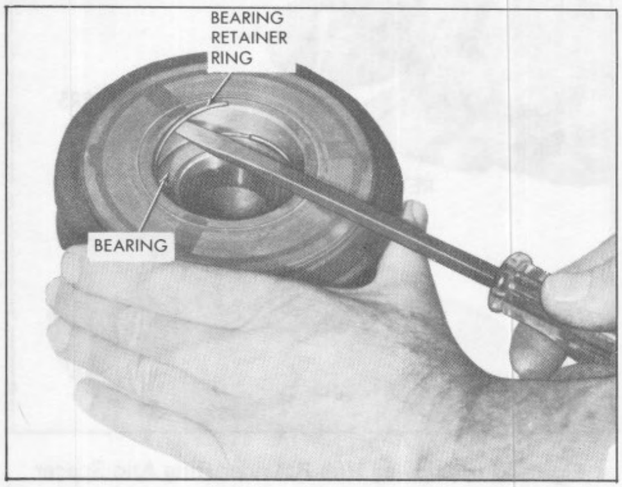


Fig. 1-46 Removing Pulley and Bearing Retainer Ring

b. Installation

1. If original pulley and bearing assembly is to be reinstalled, wipe frictional surface of pulley clean. If frictional surface of pulley shows any indication of damage due to overheating, pulley should be replaced.

2. Check bearing for brinelling, excessive looseness, noise, and lubricant leakage. If any of these conditions exist, bearing should be replaced. The procedure for replacing bearing is described in Note 34.

3. Press or tap pulley and bearing assembly on neck of compressor until it seats, using Pulley and Bearing Installer, J-9481, with Universal Handle, J-8092, Fig. 1-45. Installer will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

5. Install retainer ring using Snap Ring Pliers, J-6435 (#26).

6. Install absorbent sleeve in compressor neck.

7. Install absorbent sleeve retainer in neck of compressor. Using sleeve from Seal Seat Remover J-9393, install retainer so that outer edge is recessed 1/32" from compressor neck face.

8. Install clutch plate and hub assembly as described in Note 32b.

34. Compressor Pulley Bearing Replacement

1. Remove clutch plate and hub assembly as described in Note 32a.

2. Remove pulley and bearing assembly as described in Note 33a.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool, Fig. 1-46.

4. Place pulley and bearing assembly on inverted Support Block, J-9521, and, using Pulley Bearing Remover, J-9398, with Universal Handle, J-8092, drive bearing assembly out of pulley, Fig. 1-47.

5. Install new bearing in pulley using Pulley and Bearing Installer J-9481 with Universal Handle, J-8092, Fig. 1-48. The tool will apply the force to the outer race of the bearing.

Fig. 1-47 Removing Bearing From Pulley

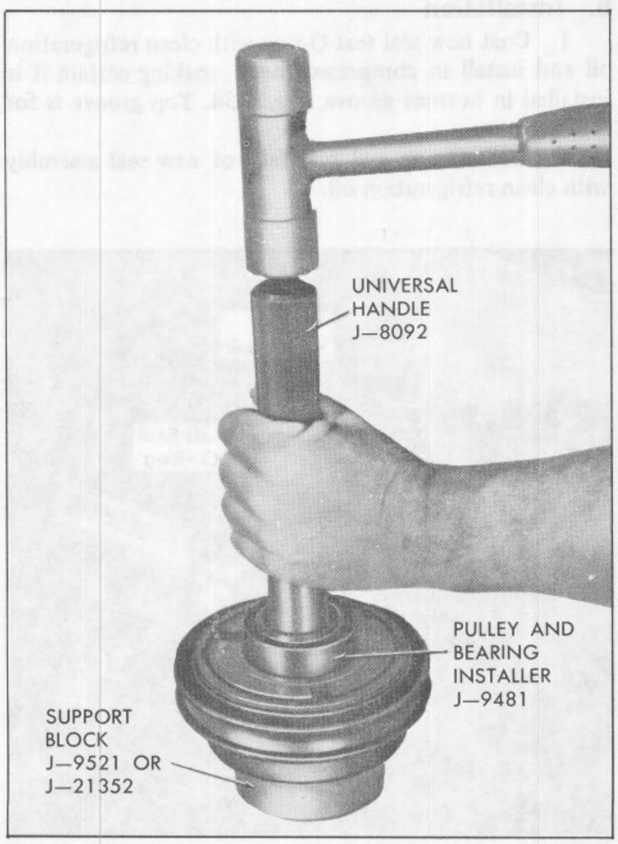


Fig. 1-48 Installing Bearing on Pulley

CAUTION: Do not clean new bearing assembly with any type of solvent. Bearing is supplied with correct lubricant when assembled and requires no other lubricant at any time.

6. Install bearing retainer ring, make certain that it is properly seated in ring groove.

7. Install pulley and bearing assembly as described in Note 33b.

8. Install clutch plate and hub assembly as described in Note 32b.

35. Compressor Clutch Coil and Housing Assembly

The coil has 3.85 ohms resistance at 80°F (ambient temperature) and should draw 3.2 amps at 12 volts.

a. Removal

1. Remove clutch plate and hub assembly as described in Note 32a.

2. Remove pulley and bearing assembly as described in Note 33a.

3. Note position of terminals on coil housing and scribe location on compressor front head casting.

4. Remove coil housing retaining ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-49.

5. Lift coil and housing assembly off compressor.

b. Installation

1. Position coil and housing assembly on compressor front head casting so electrical terminals line up with marks previously scribed on compressor.

2. Align locating extrusions on coil housing with holes in front head casting.

3. Install coil housing retainer ring, with flat side of ring facing coil, using Snap Ring Pliers, J-6435 (#26).

4. Install pulley and bearing assembly as described in Note 33b.

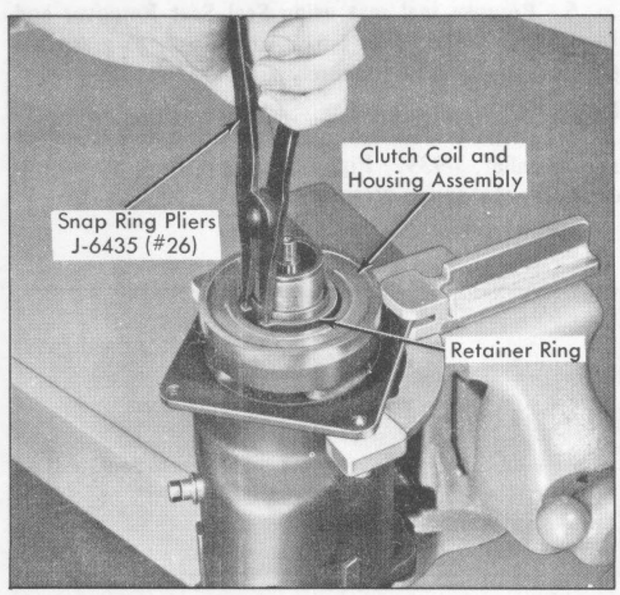


Fig. 1-49 Removing Coil Housing Retainer Ring

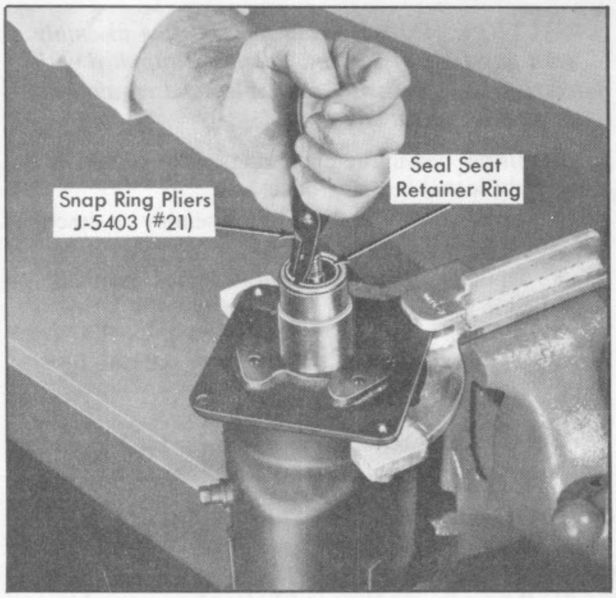


Fig. 1-50 Removing Seal Seat Retainer Ring

5. Install clutch plate and hub assembly as described in Note 32b.

36. Compressor Shaft Seal Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 32a.

2. Pry out sleeve retainer and remove sleeve.

3. Remove seal seat retainer ring using Snap Ring Pliers, J-5403 (#21), Fig. 1-50.

(NOTE: Illustration shows coil and housing removed. However, this is not necessary.)

4. Thoroughly clean inside of the compressor neck area surrounding the shaft, exposed portion of seal seat, and the shaft itself of any dirt or foreign material.

5. Remove seal seat using Seal Seat Remover and Installer, J-23128, Fig. 1-51. Adjust tool to grasp the flange of the seal seat securely and remove with a twist-pull motion.

6. Remove shaft seal assembly using Seal Remover and Installer, J-9392, Fig. 1-52. Press down on tool to overcome seal spring pressure and twist tool clockwise to

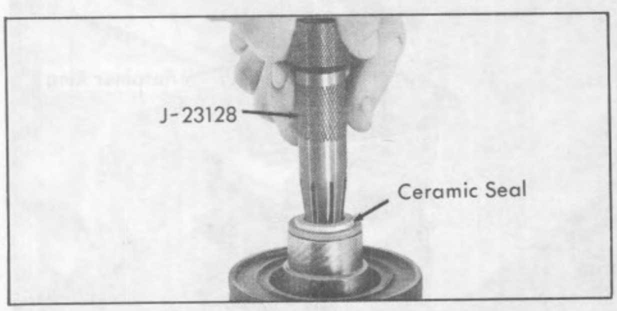


Fig. 1-51 Removing Seal Seat

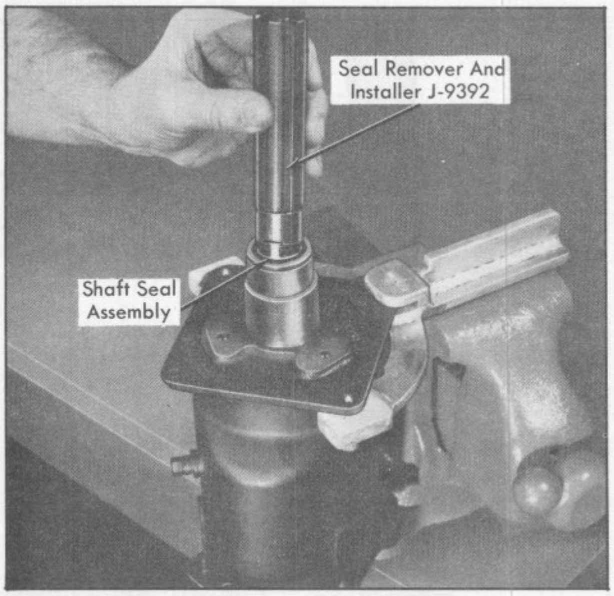


Fig. 1-52 Removing Shaft Seal Assembly

engage tabs on seal assembly with locking tangs on tool. Remove seal assembly by pulling straight out from shaft.

7. Remove seal seat O-ring from compressor neck. A wire with a hook formed on the end may be used, Fig. 1-53.

8. Re-check the shaft and inside of compressor neck for dirt or foreign material and be sure those areas are perfectly clean before installing new parts.

b. Installation

1. Coat new seal seat O-ring with clean refrigeration oil and install in compressor neck, making certain it is installed in bottom groove, Fig. 1-54. Top groove is for retainer ring.

2. Coat O-ring and seal face of new seal assembly with clean refrigeration oil.

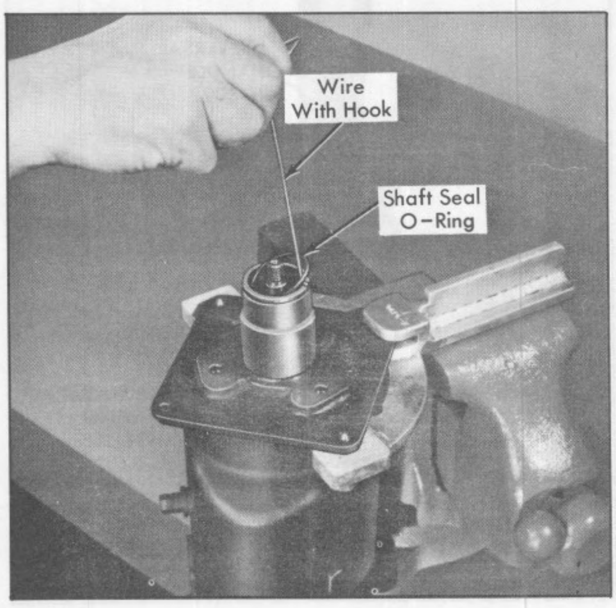


Fig. 1-53 Removing Shaft Seal O-Ring

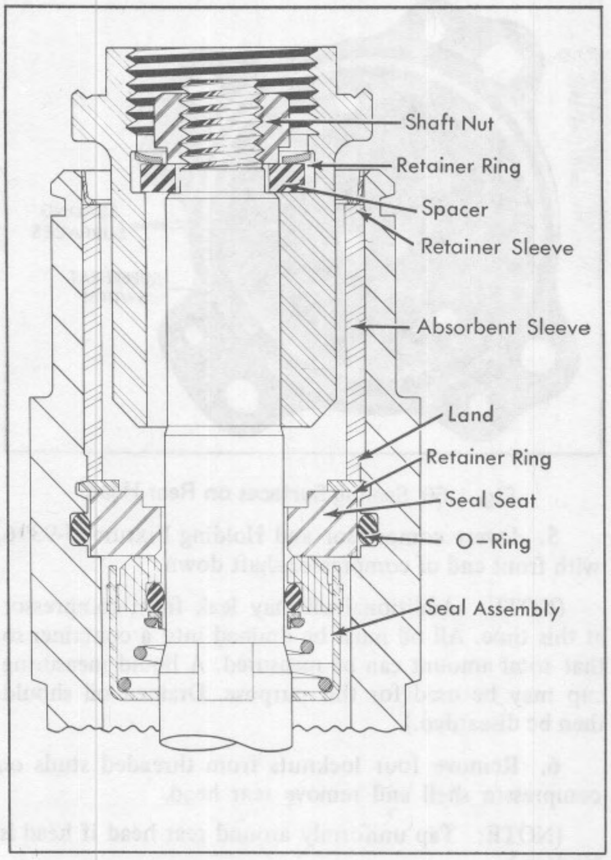


Fig. 1-54 Shaft Seal and Seat Installed

3. Carefully engage tabs on new seal assembly with tangs of Seal Remover and Installer, J-9392 and install new seal assembly over flats on shaft. Turn tool counter-clockwise to release it from seal tabs and remove tool.

4. If ceramic seat is being installed, coat seal face of new seal seat with clean refrigeration oil and install new seal seat, using Seal Seat Remover and Installer, J-23128. The seal seat is installed with the tool by a twist-push motion until the seat bottoms on the compressor shaft.

5. If carbon seat is being installed, coat seal face of new seal seat with clean refrigeration oil and install new seal seat, using Seal Seat Remover and Installer, J-9393. With either type seat, make sure seal seat O-ring is not dislodged and seal seat is making a good seal with the O-ring.

CAUTION: Seal faces of seal assembly and seal seat must be protected against dirt or any damage, such as scratches and nicks. Even finger markings are to be avoided. Contamination or damage may cause seal to leak.

6. Install new seal seat retainer ring, with flat face against the seal seat, using Snap Ring Pliers, J-5403 (#21). Sleeve from Seal Seat Remover and Installer, J-9393, may be used to press on the retainer ring so that it snaps into its groove, Fig. 1-54.

7. Leak test compressor as described in Note 43. Correct any leaks found.

8. Wipe out any excess oil inside compressor neck and on shaft, resulting from installing the new seal parts.

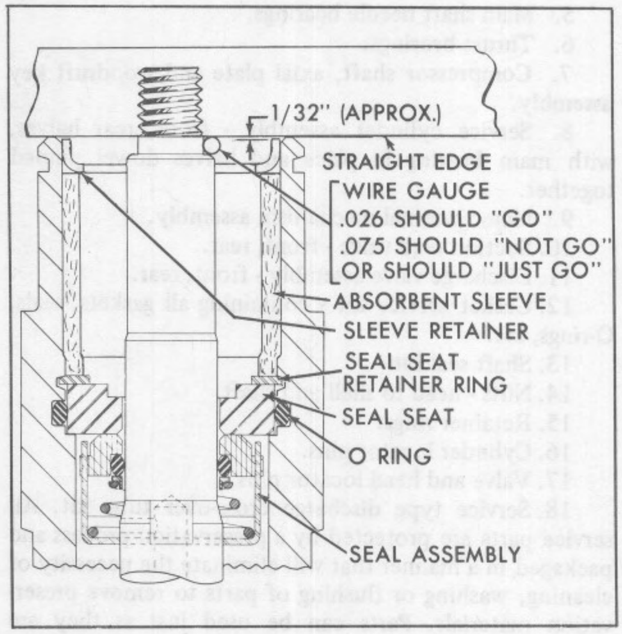


Fig. 1-55 Gaging Seal Retainer

9. Install new absorbent sleeve by rolling the material into a cylinder, overlapping the ends, and slipping the sleeve into the compressor neck with the overlap toward top of compressor.

10. With a small screwdriver or similar instrument, carefully spread the sleeve to remove overlap so that in the final position ends of the sleeve will butt at the top vertical centerline.

11. Position new metal sleeve retainer so that its flange face will be against the end of the sleeve. Using sleeve from Seal Seat Remover, J-9393, press and tap with a soft-faced hammer, setting the retainer and sleeve into place, until the outer edge of the retainer is recessed approximately 1/32" from the face of the compressor neck.

12. The 1/32" dimension is critical and may be checked by using wire gages as shown in Fig. 1-55.

13. Install clutch plate and hub assembly as described in Note 32b.

37. Compressor Overhaul Information

Whenever a compressor is damaged to the point where metal particles or black oil are prevalent, the dessicant bag should be replaced.

Whenever a major overhaul or rebuild is performed on a compressor, it is essential that the recommended service tools be available in order to perform the various service operations properly. In addition, an adequate supply of service parts should be available. Service parts should include the following.

1. Standard size piston drive balls.
2. Shoe discs - total of 11 sizes, including the ZERO shoe.
3. Thrust races - total of 16 sizes, including the ZERO race.
4. Pistons.

5. Main shaft needle bearings.
6. Thrust bearings.
7. Compressor shaft, axial plate and woodruff key assembly.
8. Service cylinder assembly - front, rear halves, with main bearing in place and halves dowel pinned together.
9. Major internal mechanism assembly.
10. Suction reed valve - front, rear.
11. Discharge valve assembly - front, rear.
12. Gasket service kit - containing all gaskets, seals, O-rings, etc.
13. Shaft seal kit.
14. Nuts - head to shell and shaft.
15. Retainer rings.
16. Cylinder locator pins.
17. Valve and head locator pins.
18. Service type discharge cross-over tube kit. All service parts are protected by a preservation process and packaged in a manner that will eliminate the necessity of cleaning, washing or flushing of parts to remove preservation materials. Parts can be used just as they are removed from service package.

Certain parts are identified on the piece part to denote their size or dimension. This applies to piston shoe discs and shaft thrust races.

Gasket service kit contains shaft seal O-ring, head to shell O-rings, oil tube inlet O-ring, and discharge cross-over tube O-ring. This kit should be used to replace all seals and gaskets whenever a compressor is overhauled or an individual component is replaced.

There is an optional method of handling one of the major internal components -- the cylinder assembly. A service cylinder assembly, including bearings, and both front and rear halves of cylinders mated together, is available for service.

There may be occasions where it would be desirable to use this assembly rather than the complete internal assembly. In case it is used, the gaging and parts selection operations will have to be performed as described in Note 40.

An inspection should be made of the internal mechanism assembly to determine if any service operations should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them.

Before proceeding with disassembly, wipe exterior surface of compressor clean.

All oil in compressor should be drained and measured. Assist draining by positioning compressor with oil drain plug down, open suction connector and rotate drive shaft several times.

38. Compressor Internal Mechanism Removal

1. Remove clutch plate and hub assembly as described in Note 32a.
2. Remove pulley and bearing assembly as described in Note 33a.
3. Remove clutch coil and housing assembly as described in Note 35a.
4. Remove shaft seal as described in Note 36a.

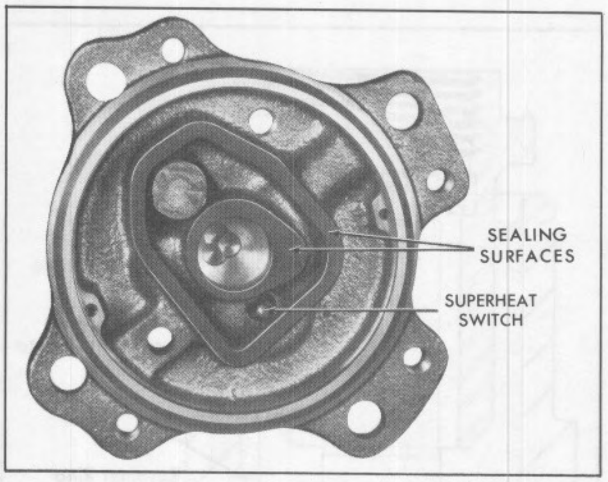


Fig. 1-56 Sealing Surfaces on Rear Head

5. Invert compressor and Holding Fixture, J-9396, with front end of compressor shaft down.

(NOTE: Additional oil may leak from compressor at this time. All oil must be drained into a container so that total amount can be measured. A liquid measuring cup may be used for this purpose. Drained oil should then be discarded.)

6. Remove four locknuts from threaded studs on compressor shell and remove rear head.

(NOTE: Tap uniformly around rear head if head is binding.)

7. Wipe excess oil from all sealing surfaces on rear head casting webs, and examine sealing surfaces, Fig. 1-56. If any damage is observed, head should be replaced.
8. Remove suction screen and examine for any damage or contamination. Clean or replace if necessary.
9. Paint an identifying mark (prussian blue or other suitable marking material may be used) on exposed face of inner and outer oil pump gears and then remove gears.

(NOTE: Identifying marks are to assure that gears, if reused, will be installed on identical position.)

10. Remove and discard rear head to shell O-ring.

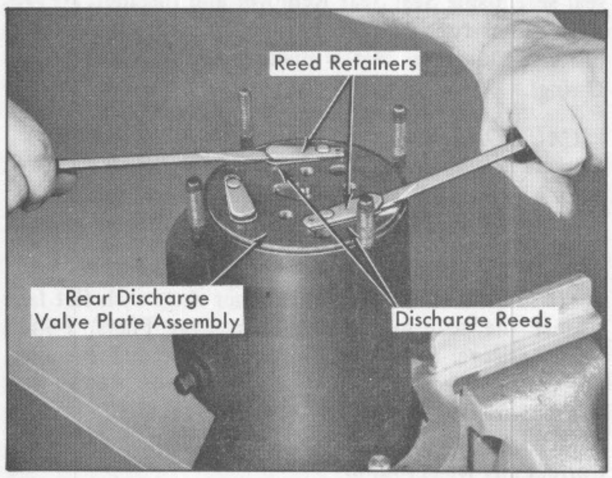


Fig. 1-57 Removing Rear Discharge Valve Ports

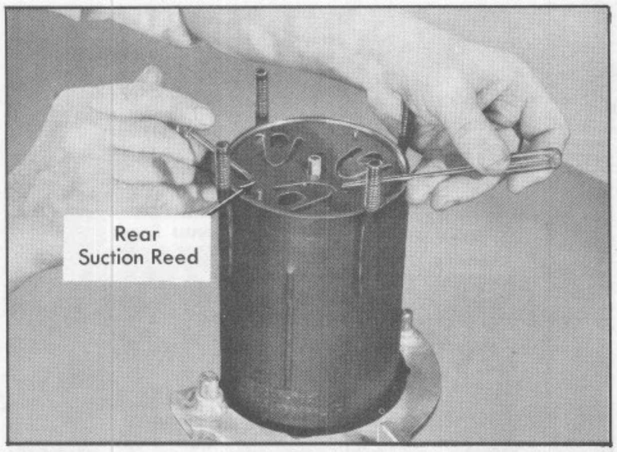


Fig. 1-58 Removing Rear Suction Reed

11. Carefully remove rear discharge valve plate assembly. Use two small screwdrivers under reed retainers and pry up on assembly Fig. 1-57. Do not position screwdrivers between reeds and reed seats.

12. Examine valve reeds and seats. Replace entire assembly if any reeds or seats are damaged.

13. Using two small screwdrivers, carefully remove rear suction reed, Fig. 1-58. Do not pry up on horseshoe shaped reed valves.

14. Examine reeds for damage, and replace if necessary.

15. Using Oil Pick-Up Tube Remover, J-5139, Fig. 1-59 remove oil pick-up tube. Remove O-ring from oil inlet.

16. Loosen compressor from Holding Fixture, place Internal Assembly Support Block, J-9521, over oil pump shaft and, holding Support Block in position with one hand, lift compressor from Holding Fixture with other hand. Invert compressor and position on bench with Internal Assembly Support Block resting on bench.

17. Lift front head and compressor shell assembly up, leaving internal mechanism resting on Internal Assembly Support Block.

CAUTION: To prevent damage to shaft, do not tap on end of compressor shaft to remove internal mechanism. If mechanism will not slide out of compressor shell, tap on front head with a plastic hammer.

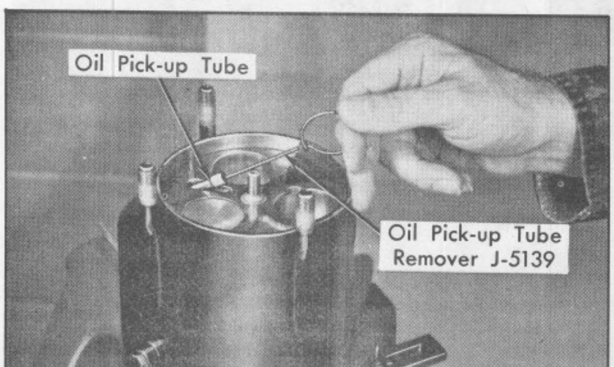


Fig. 1-59 Removing Oil Pick-Up Tube

18. Rest compressor shell on its side and push front head assembly through compressor shell, being careful not to damage sealing areas on inner side of front head. Discard O-ring.

(NOTE: It may be necessary to tap on outside of front head, using a plastic hammer, to overcome friction of O-ring seal between front head and compressor shell.)

19. Wipe excess oil from sealing surfaces on front head casting webs and examine sealing surface. If any damage is observed, head should be replaced.

20. Remove front discharge valve plate assembly and front suction reed plate. Examine reeds and seats. Replace necessary parts.

21. Remove suction cross-over cover by prying with screwdriver between cylinder casting and cover.

(NOTE: Examine internal mechanism for any obvious damage. If internal mechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to use the service internal mechanism assembly rather than replace individual parts.)

39. Compressor Internal Mechanism Disassembly

Use Parts Tray, J-9402, to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in Note 38.

2. Identify by pencil mark, or some other suitable means, each piston numbering them 1, 2, and 3. Fig. 1-60. Number the piston bores in the front cylinder half in like manner so that pistons can be replaced in their original locations.

3. Separate cylinder halves, using a wood block and mallet, Fig. 1-61. Make certain that discharge cross-over tube does not contact axial plate when separating cylinder halves.

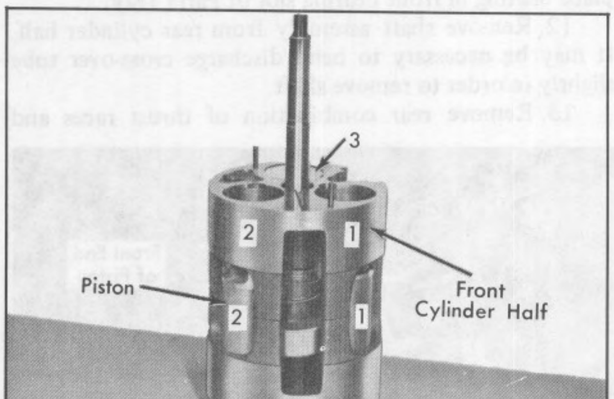


Fig. 1-60 Numbering Piston and Cylinder Bores

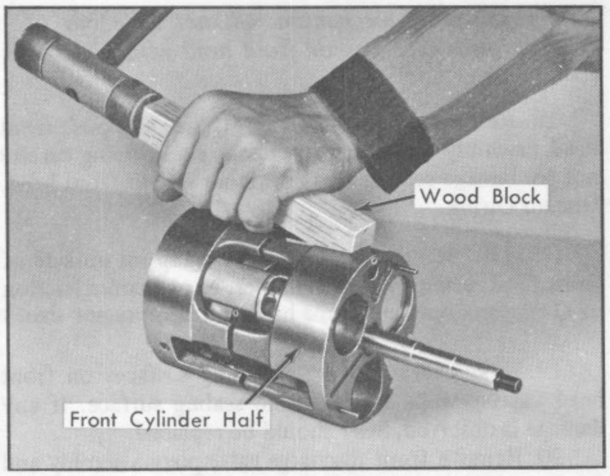


Fig. 1-61 Separating Cylinder Halves

CAUTION: Under no circumstances should shaft be struck at either end in an effort to separate upper and lower cylinder halves because shaft could be damaged.

4. Position complete internal mechanism, rear cylinder down, on Support Block, J-9521, and remove front cylinder half.

5. Pull up on compressor shaft and remove piston previously identified as #1, with balls and shoe discs, from axial plate.

6. Remove and discard piston shoe discs.

7. Remove and examine piston balls, and if satisfactory for re-use, place balls in #1 compartment of Parts Tray.

8. Remove piston rings and examine for re-use. If satisfactory, place in proper slots below #1 piston in Parts Tray.

9. Place piston in #1 compartment of Parts Tray with notch in casting web at front end of piston in dimpled groove of compartment, Fig. 1-62.

10. Repeat steps 5 through 9 for pistons #2 and #3.

11. Remove front combination of thrust races and thrust bearing from shaft, Fig. 1-63. Discard races and place bearing in front bearing slot of Parts Tray.

12. Remove shaft assembly from rear cylinder half. It may be necessary to bend discharge cross-over tube slightly in order to remove shaft.

13. Remove rear combination of thrust races and

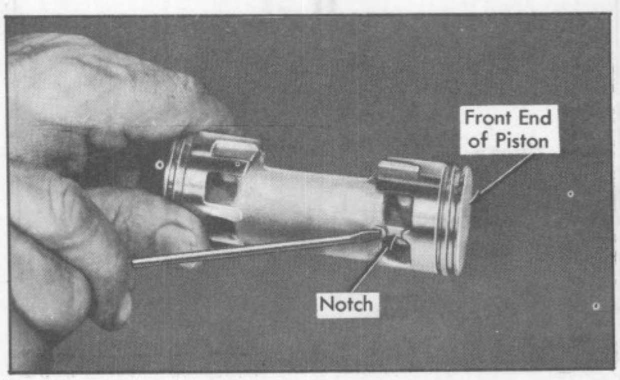


Fig. 1-62 Compressor Piston

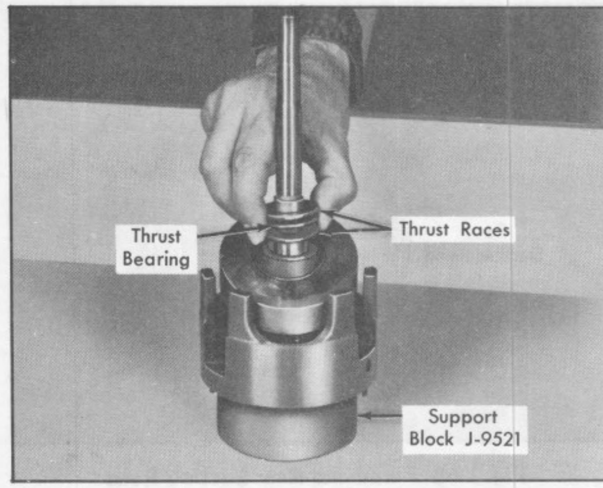


Fig. 1-63 Removing Front Thrust Races and Bearing

bearing from shaft. Discard races and place bearing in rear bearing slot in Parts Tray.

14. Examine surface of axial plate and shaft. Replace as an assembly, if necessary. Examine front and rear thrust bearings and replace if necessary.

(NOTE: A certain amount of shoe disc wear on axial plate is normal as well as some markings indicating load of needle bearings on shaft.)

15. Remove discharge cross-over tube from cylinder half, using self clamping pliers.

(NOTE: This is necessary only on original factory equipment as ends of the tube are swedged into cylinder halves. The discharge cross-over tube in internal mechanism assemblies that have been previously serviced have an O-ring and bushing at each end of the tube, and can be easily removed by hand.)

16. Examine piston bores and needle bearings in front and rear cylinder halves. Replace front and rear cylinders if any cylinder bore is deeply scored or damaged.

17. Needle bearings may be removed if necessary by

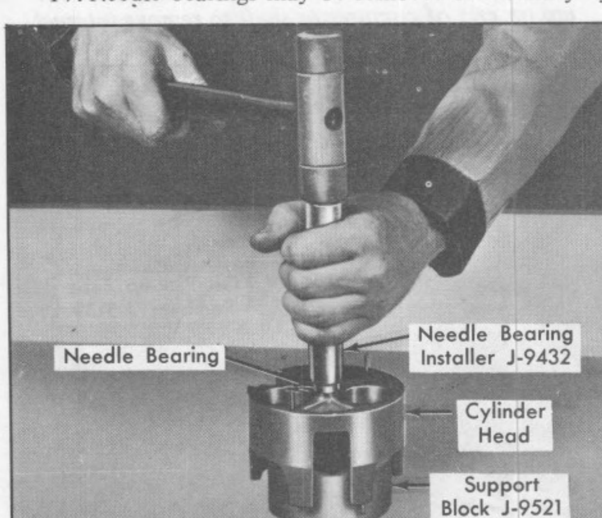


Fig. 1-64 Installing Needle Bearings

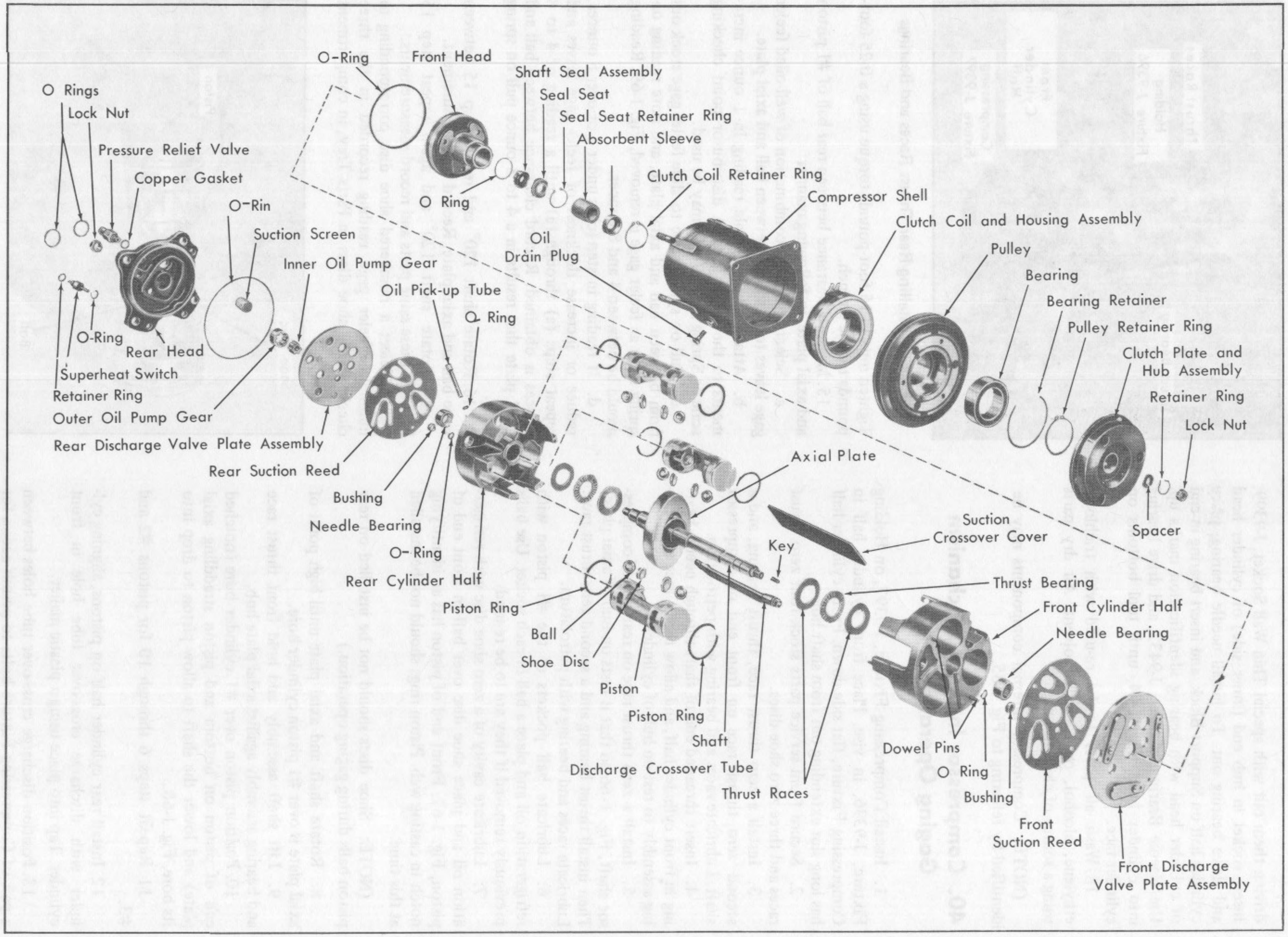


Fig. 1-65 Compressor Disassembled

driving them out with special Thin Wall Socket, J-9399. Insert socket in hub end (inner side) of cylinder head and drive bearing out. To install needle bearing, place cylinder half on Support Block, and insert bearing in end of cylinder head with bearing identification marks up. Use Needle Bearing Installer, J-9432, and drive bearing into cylinder head, Fig. 1-64, until tool bottoms on cylinder face.

18. Wash all parts to be re-used with trichloroethylene, alcohol, or a similar solvent. Air dry parts using a source of clean dry air.

(NOTE: Compressor internal components may be identified by referring to Fig. 1-65.

40. Compressor Internal Mechanism Gaging Operation

1. Install Compressing Fixture, J-9397, on Holding Fixture, J-9396, in vise. Place front cylinder half in Compressing Fixture, flat side down. Front cylinder half has long slot extending out from shaft hole.

2. Secure from service parts stock four zero thrust races and three zero shoe discs.

3. Install a zero thrust race, thrust bearing, and a second zero thrust race on front end of compressor shaft. Lubricate races and bearing with petrolatum.

4. Insert threaded end of shaft through needle bearing in front cylinder half, and allow thrust race and bearing assembly to rest on hub of cylinder.

5. Install a zero thrust race on rear end of compressor shaft, Fig. 1-66 so that it rests on hub of axial plate. Then install thrust bearing and a second zero thrust race. Lubricate races and bearing with petrolatum.

6. Lubricate ball pockets of the #1 piston with refrigeration oil and place a ball in each socket. Use balls previously removed if they are to be re-used.

7. Lubricate cavity of a zero shoe disc with refrigeration oil and place shoe disc over ball in front end of piston, Fig. 1-67. Front end of piston has an identifying notch in casting web. Piston rings should not be installed at this time.

(NOTE: Shoe discs should not be installed on rear piston balls during gaging operation.)

8. Rotate shaft and axial plate until high point of axial plate is over #1 piston cylinder bore.

9. Lift shaft assembly and hold front thrust race and bearing assembly against axial plate hub.

10. Position piston over #1 cylinder bore (notched end of piston on bottom and piston straddling axial plate) and lower the shaft to allow piston to drop into its bore, Fig. 1-68.

11. Repeat steps 6 through 10 for pistons #2 and #3.

12. Install rear cylinder half on pistons, aligning cylinder with discharge cross-over tube hole in front cylinder. Tap into place using a plastic mallet.

13. Position discharge cross-over tube holes between a pair of Compressing Fixture bolts to permit access for feeler gage.

14. Install top plate on Compressing Fixture, J-9397.

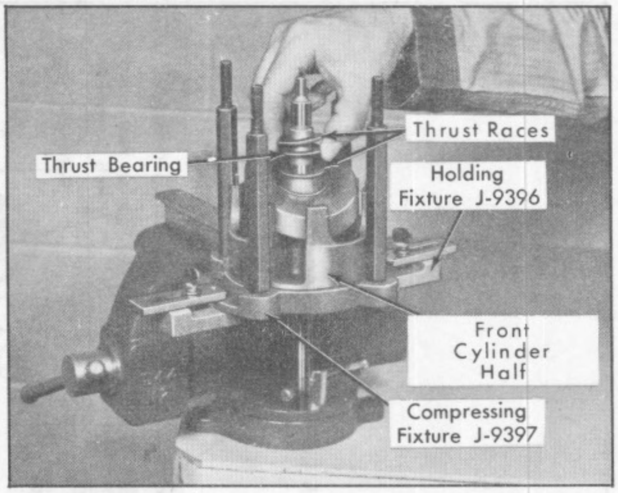


Fig. 1-66 Installing Rear Thrust Races and Bearings

Tighten nuts to 15 foot-pounds torque using a 0-25 foot-pounds torque wrench.

15. Measure clearance between rear ball of #1 piston and axial plate, in following manner:

a. Select a suitable combination of well-oiled feeler gage leaves to fit snugly between ball and axial plate.

b. Attach a spring scale reading in 1 ounce increments to the feeler gage. A distributor point checking scale or Spring Scale, J-544 may be used.

c. Pull on spring scale to slide feeler gage stock out from between ball and axial plate, and note reading on spring scale as feeler gage is removed, Fig. 1-69. Reading should be between 4 and 8 ounces.

d. If reading in step (c) is under 4 or over 8 ounces, reduce or increase thickness of feeler gage leaves and repeat steps (a) through (c) until a reading of 4 to 8 ounces is obtained. Record clearance between ball and axial plate that results in a 4 to 8 ounce pull on spring scale.

16. Rotate shaft 120° and repeat step 15 between same ball and axial plate. Record this measurement.

17. Rotate shaft 120° and again repeat step 15 between these same parts and record measurements.

18. Select a numbered shoe disc corresponding to minimum feeler gage reading recorded in the three checks. Place shoe discs in Parts Tray, in compartment

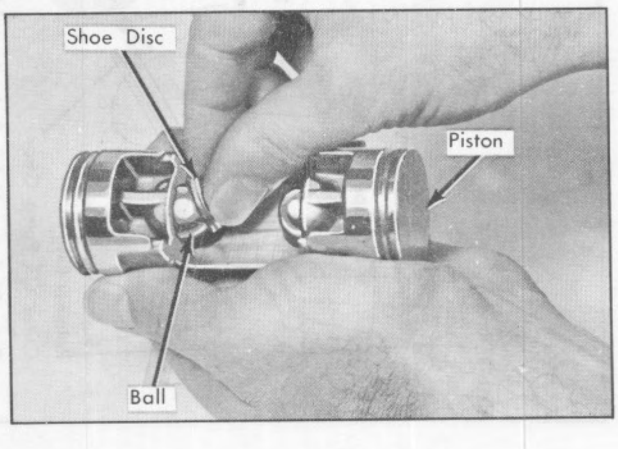


Fig. 1-67 Installing Shoe Disc

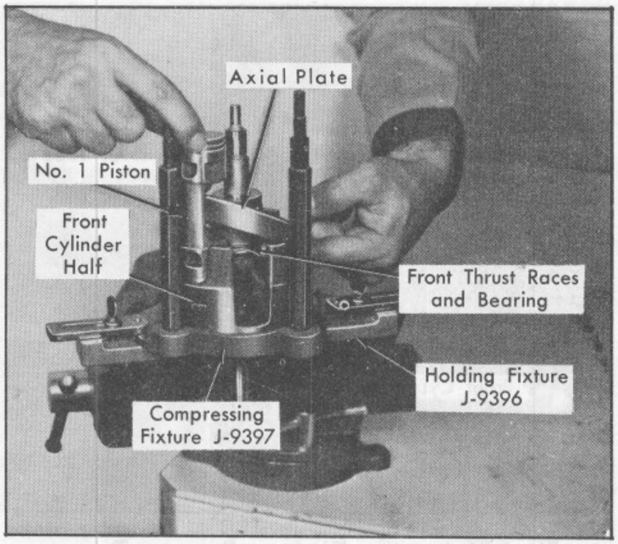


Fig. 1-68 Installing Piston

corresponding to piston #1 and rear ball pocket position.

(NOTE: Shoe discs are provided in .0005 inch (one-half thousandths) variations. There are a total of eleven sizes available for field servicing. All shoe discs are marked with the shoe size, which corresponds to the last three digits of the piece part number. See shoe disc size chart on page 1-65.)

Once proper selection of shoe has been made, the matched combination of shoe disc to rear ball and spherical cavity in piston must be kept in proper relationship during disassembly after gaging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gaging operation outlined in steps 15 through 18 for pistons #2 and #3.

20. Mount Dial Indicator, J-8001-3, on edge of Compressing Fixture with Clamp, J-8001-1, and Sleeve, J-8001-2, Fig. 1-70. Position Dial Indicator on rear end of shaft and adjust to zero. Push front end of shaft upward and record measurement.

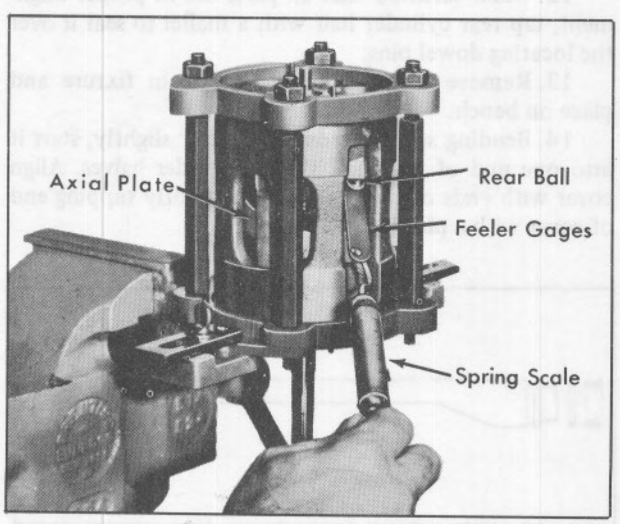


Fig. 1-69 Gaging Rear Piston Ball

Last 3 Digits of Part No.	No. Stamped on Shoe	Min. Feeler Gage Reading
000	0	.0000
175	17-1/2	.0175
180	18	.0180
185	18-1/2	.0185
190	19	.0190
195	19-1/2	.0195
200	20	.0200
205	20-1/2	.0205
210	21	.0210
215	21-1/2	.0215
220	22	.0220

(NOTE: Dial Indicator increments are .001 inch; therefore, reading must be estimated to nearest .0005 inch.)

21. Select a thrust race with a number corresponding to the amount of end play shown. Place thrust race in right hand slot at bottom center of Parts Tray.

(NOTE: Fifteen thrust races are provided in increments of .0005 inch (one-half thousandths) thickness and one zero gage thickness providing a total of 16 sizes available for field service. Thrust races are identified on the part by their thickness in thousands in excess of the thickness of the zero thrust race.)

This number also corresponds to the last three digits of the piece part number. See thrust race size chart.

A tolerance of .0005 inch to .0015 inch is built into thrust races to provide a running clearance between hub

THRUST RACE SIZE CHART

Last 3 Digits of Part No.	No. Stamped on Thrust Race	Dial Indicator Reading
000	0	.0000
050	5	.0050
055	5-1/2	.0055
060	6	.0060
065	6-1/2	.0065
070	7	.0070
075	7-1/2	.0075
080	8	.0080
085	8-1/2	.0085
090	9	.0090
095	9-1/2	.0095
100	10	.0100
105	10-1/2	.0105
110	11	.0110
115	11-1/2	.0115
120	12	.0120

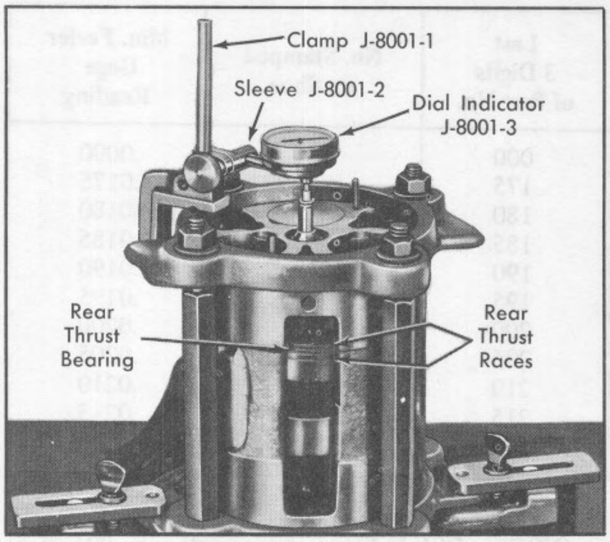


Fig. 1-70 Gaging Rear Thrust Race

surfaces of axial plate and front and rear hubs of cylinder.

22. Remove nuts from top plate of Compressing Fixture, and remove top plate.

23. Separate cylinder halves while unit is in fixture. It may be necessary to use a wood block and mallet.

24. Remove rear cylinder half and carefully remove one piston at a time from axial plate and front cylinder half. Do not lose the relationship of the front ball and shoe disc and rear ball. Transfer each piston, ball, and shoe disc to its proper place in Parts Tray.

25. Remove rear outer zero thrust race from shaft and install thrust race previously selected.

(NOTE: The zero thrust race may be put aside for re-use in additional gaging or rebuilding operations.)

41. Compressor Internal Mechanism Assembly

1. Install a piston ring on each end of #1 piston, with scraper groove toward center of piston.

2. Lubricate ball pockets of pistons with refrigeration oil and place the corresponding balls from the Parts Tray in each pocket.

3. Lubricate cavities of #1 piston shoe discs with refrigeration oil and place zero shoe disc over ball in front end of piston and numbered shoe disc over ball in rear end of piston.

4. Rotate shaft and axial plate until high point of axial plate is over #1 piston cylinder bore.

(NOTE: Make certain that front thrust race and bearing assembly adhere to axial plate hub.)

5. Position piston over #1 cylinder bore with notched end of piston on bottom and piston straddling axial plate and lower shaft to allow piston to drop into its bore.

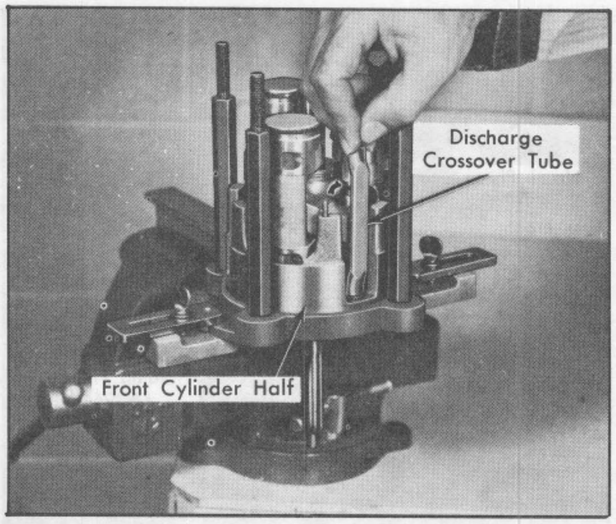


Fig. 1-71 Installing Discharge Crossover Tube

6. Position piston ring gap toward shaft, compress ring and lower ring into front cylinder half.

7. Repeat steps 1 through 6 for pistons #2 and #3.

8. Install new discharge cross-over tube in front cylinder half with bridged surface facing outboard, Fig. 1-71. Make certain that end of tube is properly centered in hole in front cylinder half.

(NOTE: The service discharge cross-over tube is similar to the production type tube except that an O-ring and bushing is used at each end, Fig. 1-72. Do not install O-ring or bushing at this time.)

9. Rotate shaft to position pistons in a stairstep arrangement. Position rings on each piston so that ring gaps are toward shaft, then push rings as far outboard as possible.

10. Place rear cylinder half over shaft and start pistons and rings into cylinder bores.

11 When all three pistons and rings are in their respective bores, align end of discharge cross-over tube with hole in rear cylinder half. Make certain that bridged surface of tube faces outboard for axial plate clearance.

12. When satisfied that all parts are in proper alignment, tap rear cylinder half with a mallet to seat it over the locating dowel pins.

13. Remove internal mechanism from fixture and place on bench.

14. Bending suction cross-over cover slightly, start it into one end of dove tail slot in cylinder halves. Align cover with ends of cylinder faces by gently tapping end of cover with a plastic hammer.

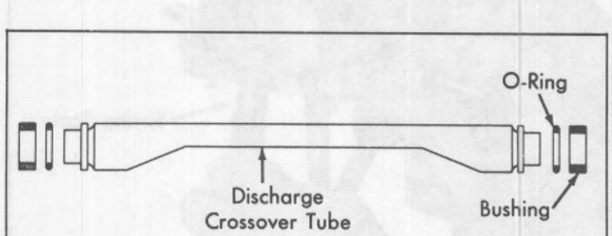


Fig. 1-72 Service Type Crossover Tube

Fig. 1-73 Installing O-Ring on Crossover Tube

42. Compressor Internal Mechanism Installation

1. Place internal mechanism on Internal Assembly Support Block J-9521, with rear end of shaft in block hole.

2. Install new O-ring and bushing on front end of discharge cross-over tube, Fig. 1-73. The O-ring and bushing are service parts only for internal mechanisms that have been disassembled in the field.

3. Install new dowel pins in front cylinder half, if previously removed.

4. Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge cross-over tube, Fig. 1-74.

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate, Fig. 1-75.

(NOTE: front discharge plate has a large diameter hole in the center, Fig. 1-76.

6. Coat sealing surfaces on webs of compressor front head casting with 525 viscosity refrigeration oil.

7. Determine exact position of front head casting in relation to dowel pins on internal mechanism. Mark position of dowel pins on sides of front head assembly and on sides of internal mechanism with a grease pencil. Carefully lower front head casting into position, Fig. 1-77, making certain that sealing area around center bore of head assembly does not contact shaft as head assembly is lowered. Do not rotate head assembly to line up with dowel pins, as sealing areas would contact reed retainers.

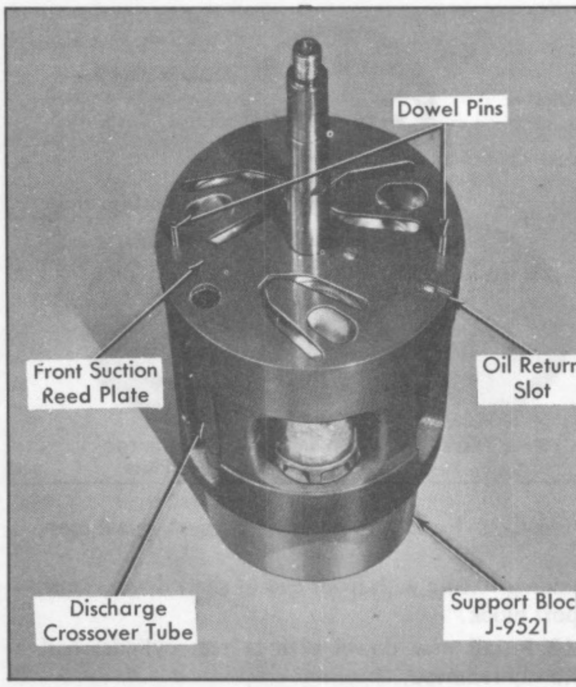


Fig. 1-74 Installing Front Suction Reed

8. Generously lubricate angled groove at lower edge of front head casting with 525 viscosity refrigeration oil and install new O-ring in groove, Fig. 1-78.

9. Coat inside machine surfaces of compressor shell with 525 viscosity refrigeration oil and position shell on internal mechanism, resting on O-ring seal.

10. Using flat side of a small screwdriver, gently press O-ring in around circumference of internal mechanism until compressor shell slides down over internal mechanism. As shell slides down, line up oil sump with oil intake tube hole, Fig. 1-79.

11. Holding support block, invert assembly and place

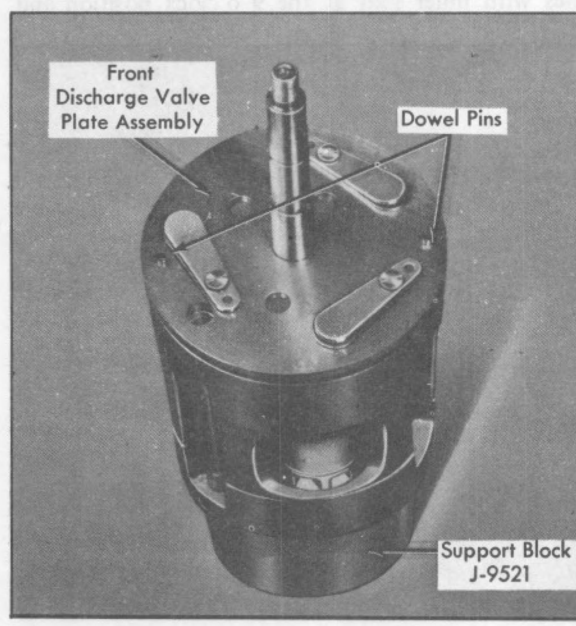


Fig. 1-75 Installing Front Discharge Valve Plate

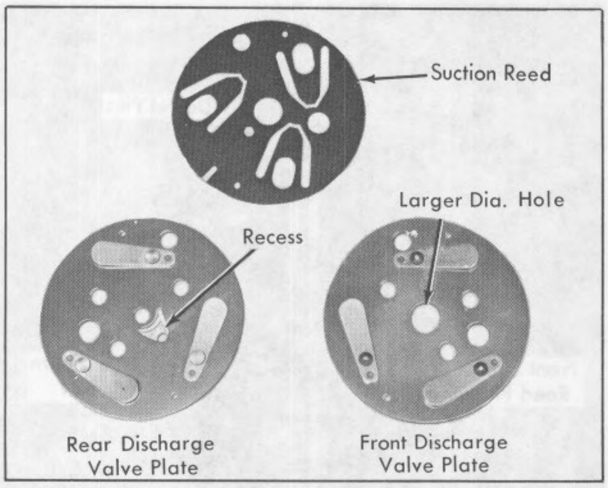


Fig. 1-76 Front and Rear Discharge Valve Plates

in holding fixture with front end of shaft down. Remove support block.

12. Install new dowel pins in rear cylinder half if previously removed.

13. Install new O-ring in oil pick-up tube cavity.

14. Lubricate oil pick-up tube and install in cavity, rotating compressor mechanism to align tube with hole in shell baffle, Fig. 1-80.

15. Install new O-ring and bushing on rear of discharge cross-over tube.

16. Install rear suction reed over dowel pins with slot toward sump.

17. Install rear discharge valve plate assembly over dowel pins with reed retainers up.

18. Position inner oil pump gear over shaft with previously applied identification mark up.

19. Position outer oil pump gear over inner gear with previously applied identification mark up and, when standing facing oil sump, position outer gear so that it meshes with inner gear at the 9 o'clock position and

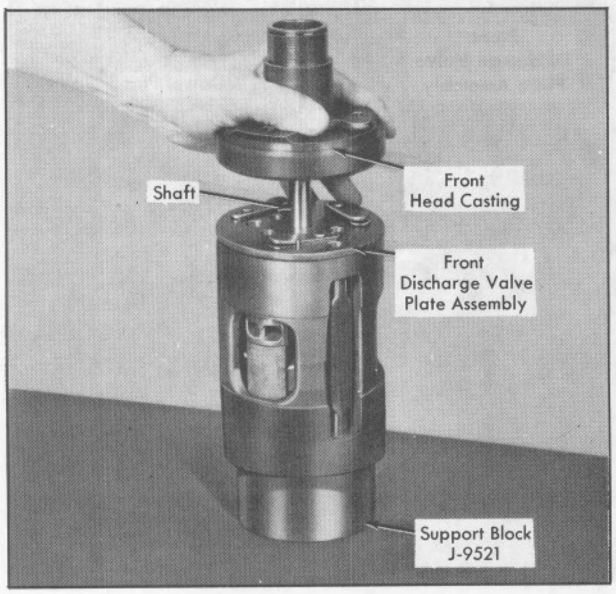


Fig. 1-77 Installing Front Head Casting

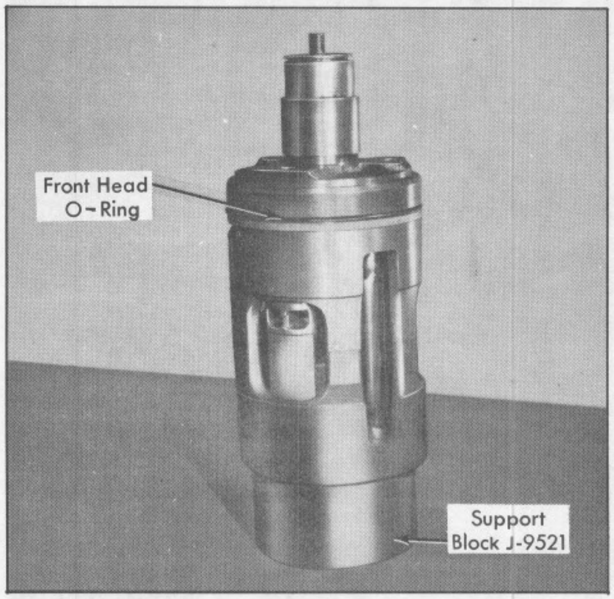


Fig. 1-78 Front Head O-Ring Installed

cavity between gear teeth is at 3 o'clock position, Fig. 1-81.

20. Generously oil rear discharge valve plate assembly around outer edge where large diameter O-ring will be placed. Oil valve reeds, pump gears, and area where sealing surface will contact rear discharge valve plate.

21. Lubricate new head to-shell O-ring and install on rear discharge valve plate, in contact with shell.

22. Install suction screen in rear head casting, using care not to damage screen.

23. Coat sealing surface on webs of compressor rear head casting with 525 viscosity refrigeration oil.

24. Install rear head assembly over studs on compressor shell. The two lower threaded compressor mounting holes should be in alignment with the compressor sump

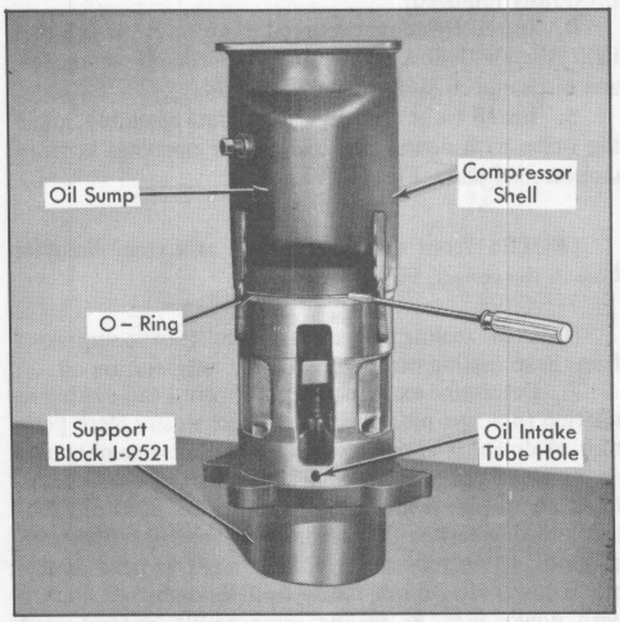


Fig. 1-79 Installing Compressor Shell

Fig. 1-80 Installing Oil Pick-Up Tube

Make certain that suction screen does not drop out of place when lowering rear head into position.

(NOTE: If rear head assembly will not slide down over dowels in internal mechanism, twist front head assembly back and forth very slightly by hand until rear head drops over dowel pins.)

25. Install nuts on threaded shell studs and tighten evenly to 20 foot-pounds torque using a 0-25 foot-pounds torque wrench.

26. Invert compressor in holding fixture and install shaft seal as described in Note 36b.

27. Install compressor clutch coil and housing assembly as described in Note 35b.

28. Install compressor pulley and bearing assembly as described in Note 33b.

29. Install compressor clutch plate and hub assembly as described in Note 32b.

30. Add 525 viscosity refrigeration oil as described in Note 49.

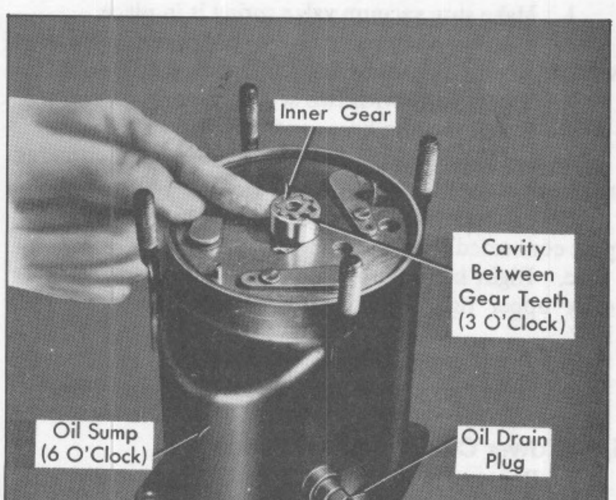


Fig. 1-81 Positioning Oil Pump Gears

31. Check for external and internal leaks as described in Note 43.

43. Compressor Leak Testing (External and Internal)

1. Rotate clutch hub clockwise several turns to pick oil up from sump and carry it to piston rings and oil seals.

2. Install Test Plate, J-9625, on rear head of compressor.

3. Attach center hose of gage manifold set on Charging Station to a refrigerant drum standing in an upright position and open valve on drum.

4. Connect charging station high and low pressure lines to corresponding fittings on Test Plate.

(NOTE: High pressure fitting is one farthest from high pressure relief valve on compressor rear head.)

5. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 4 on Charging Station to allow refrigerant vapor to flow into compressor.

6. Using Leak Detector Torch, J-6084, check for leaks at pressure relief valve, oil drain fitting, compressor rear head seal, compressor front head seal and compressor shaft seal. After checking, shut off valve 1 and valve 2 on Charging Station.

7. If an external leak is present, perform the necessary corrective procedures and repeat steps 1 through 6 to make certain leak has been corrected before proceeding with steps 8 through 12 to check for internal leaks.

8. Disconnect manifold gage hoses from test plate.

9. Bleed refrigerant from compressor low side using Gage Adapter J-5420 until down to 10 P.S.I. or less.

10. Leave Gage Adapter J-5420 and bleeding pressure from low side and connect low pressure hose of gage manifold set to high pressure fitting on Test Plate, J-9625.

11. Open charging station valve 1 (low pressure control) to allow refrigerant vapor to flow into compressor.

12. Observe reading on pressure gage then close valve 1. If gage reading drops to 10 pounds or under in 30 seconds or less, it indicates that compressor is leaking internally, at one or more of the following points:

a. Reed valves.

b. Teflon seals at rear head, or sealing surfaces on front head.

c. Cross-over tube.

d. Raised section on cylinder face.

13. If a leak is indicated in step 12, perform necessary corrective procedures to eliminate internal leak and repeat steps 1 through 12 to make certain external and internal leaks are corrected. If no leak was indicated, proceed with step 14.

14. Disconnect charging station from test plate.

15. Remove test plate from compressor.

PROGRAMMER OVERHAUL

44. Programmer Disassembly

a. Transducer Removal

1. Remove programmer as described in Note 19a.
2. Remove programmer cover.
3. Disconnect transducer electrical leads at transducer.
4. Remove vacuum hoses from transducer vacuum ports.
5. Remove screw with clip holding transducer in place and remove transducer.

b. Transducer Installation

1. Position transducer in programmer as shown in Fig. 1-82 and secure with screw and clip.
2. Connect black vacuum hose to top port (small) of transducer and white hose to lower port (large).
3. Connect electrical leads to transducer: yellow wire to inside terminal; gray wire to outside terminal.
4. Install programmer cover.
5. Install programmer as described in Note 19b.

c. Checking Relay Removal

1. Remove programmer as described in Note 19a.
2. Remove programmer cover.
3. Remove four hoses from relay and remove relay.

d. Checking Relay Installation

1. Position checking relay in programmer with ports 1 and 2 towards vacuum motor as shown in Fig. 1-82.
2. Make the following vacuum hose connections:
   a. White hose from transducer wraps around vacuum motor and connects to port #2, Fig. 1-82.

   (NOTE: If this vacuum hose is replaced, the replacement hose must be at least 15" long).

   b. Short (yellow) hose connects remaining port (#1) to vacuum motor, Fig. 1-82.
   c. Purple hose from left hand port of vacuum valve to port #3, Fig. 1-82.
   d. Remaining black hose (R.H. nipple of vacuum valve) to the port #5, Fig. 1-82.
3. Install programmer cover.
4. Install programmer as described in Note 19b.

e. Vacuum Motor Removal

1. Remove programmer as described in Note 19a.
2. Remove programmer cover.
3. Remove two screw/studs securing vacuum valve and swing valve out of way with hoses still attached.
4. Remove tension spring and clip.
5. Remove two screws securing vacuum motor to programmer housing.
6. Remove vacuum hose between checking relay and vacuum motor.
7. Loosen the output shaft bracket enough to allow the vacuum motor mechanism to be separated from the output shaft arm.
8. Remove vacuum motor with blower contact assembly remaining on circuit board.

(NOTE: Handle blower contact assembly carefully as detent balls may fall out. If blower contact assembly is removed, mark a tooth on the feedback pot and a corresponding notch on blower switch gear.)

f. Vacuum Motor Installation

1. If blower contact assembly was removed, position blower contact assembly to vacuum motor. Use care to be sure that two balls do not fall out. Engage stud of contact in slot of gear.
2. Align marks on feedback pot and blower contact gear and position vacuum motor to programmer housing. Check for third ball in casting pivot hole.
3. With vacuum motor mechanism in position on output shaft arm, tighten retaining screw on output shaft bracket.
4. Secure vacuum motor in position with two screws.
5. Install programmer vacuum valve in position and secure with two screw/studs. Check for link-up to vacuum motor.
6. Install spring between vacuum motor arm and clip around outside edge of housing.
7. Install short vacuum hose (yellow) between vacuum motor and checking relay.
8. Install programmer cover.
9. Install programmer as described in Note 19b.

g. Programmer Vacuum Valve Removal

1. Remove programmer as described in Note 19a.
2. Remove programmer cover.
3. Remove three vacuum hoses from nipples on side of valve.
4. Remove two screw/studs securing vacuum valve to housing and remove valve.

h. Programmer Vacuum Valve Installation

1. Make sure vacuum valve spring is in place.
2. Position vacuum valve to programmer housing with drive arm on boss of vacuum motor mechanism.
3. Secure valve with two screw/studs.
4. Install vacuum hoses as follows:
   a. Left hand nipple has purple hose from checking relay lower port connected to it, see Fig. 1-82.
   b. Center nipple has black hose from transducer top port connected to it, see Fig. 1-82.
   c. Right hand nipple has black hose from checking relay upper right hand port connected to it, see Fig. 1-82.
5. Install programmer cover.
6. Install programmer as described in Note 19b.

i. Blower Circuit Board Removal

1. Remove programmer as described in Note 19a.
2. Remove programmer cover.
3. Remove two screw/studs securing vacuum valve

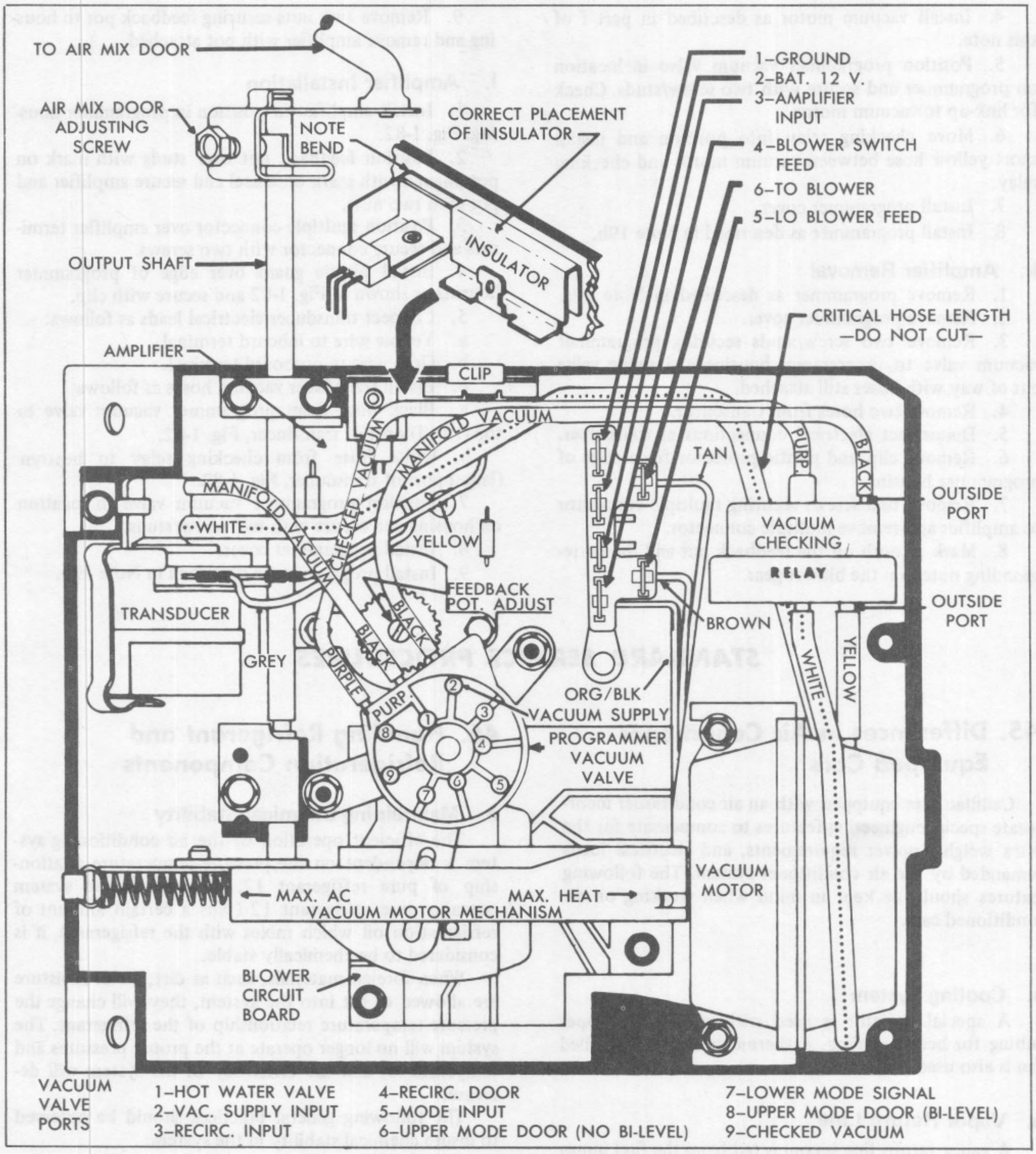


Fig. 1-82 ATC Programmer

to programmer housing and swing valve out of way with hoses still attached.

4. Remove vacuum motor as described in part e of this note.

5. Remove blower contact assembly.

6. Remove two screws securing multiple connector at amplifier.

7. Remove three screws securing circuit board to programmer housing and remove circuit board, with connector attached.

j. Blower Circuit Board Installation

1. Position connector and circuit board to programmer and secure with three screws. Refer to Fig. 1-82.

2. Install multiple connector and secure with two screws.

3. Position blower contact assembly to vacuum motor. Be sure balls do not fall out. Engage stud of contact in slot of gear.

4. Install vacuum motor as described in part f of this note.

5. Position programmer vacuum valve in location on programmer and secure with two screw/studs. Check for link-up to vacuum motor.

6. Move checking relay into position and install short yellow hose between vacuum motor and checking relay.

7. Install programmer cover.

8. Install programmer as described in Note 19b.

k. Amplifier Removal

1. Remove programmer as described in Note 19a.

2. Remove programmer cover.

3. Remove two screw/studs securing programmer vacuum valve to programmer housing and swing valve out of way with hoses still attached.

4. Remove two hoses from transducer.

5. Disconnect electrical connections at transducer.

6. Remove clip and plastic protector from edge of programmer housing.

7. Remove two screws securing multiple connector to amplifier and remove multiple connector.

8. Mark a tooth on the feedback pot and the corresponding notch on the blower gear.

9. Remove two nuts securing feedback pot to housing and remove amplifier with pot attached.

l. Amplifier Installation

1. Install amplifier in position in programmer housing, Fig. 1-82.

2. Position feedback pot over studs with mark on pot aligned with mark on wheel and secure amplifier and pot with two nuts.

3. Position multiple connector over amplifier terminals and secure connector with two screws.

4. Install plastic guard over edge of programmer housing as shown in Fig. 1-82 and secure with clip.

5. Connect transducer electrical leads as follows:

a. Yellow wire to inboard terminal.

b. Gray wire to outboard terminal.

6. Install transducer vacuum hoses as follows:

a. Black hose from programmer vacuum valve to top (small) port of transducer, Fig. 1-82.

b. White hose from checking relay to bottom (large) port of transducer, Fig. 1-82.

7. Position programmer vacuum valve in location on housing and secure with two screw/studs.

8. Install programmer cover.

9. Install programmer as described in Note 19b.

STANDARD SERVICE PROCEDURES

45. Differences in Air Conditioner Equipped Cars

Cadillac cars equipped with an air conditioner incorporate special engineering features to compensate for the extra weight, power requirements, and electrical loads demanded by the air conditioner system. The following features should be kept in mind when working on air conditioned cars.

a. Cooling System

A special radiator is used with additional copper tubing for better cooling. A thermostatically controlled fan is also used.

b. Vapor Return Line

A vapor return line is connected from the fuel pump to the fuel tank to reduce the possibility of vapor lock.

c. Generator

A 63 ampere generator is used to accommodate the greater electrical load on all cars except the limousine which uses an 80 ampere model.

d. Suspension

Front springs have higher static load rate to compensate for additional weight of the system's components (except Eldorado).

46. Handling Refrigerant and Refrigeration Components

a. Maintaining Chemical Stability

The efficient operation of the air conditioning system is dependent on the pressure-temperature relationship of pure refrigerant 12. As long as the system contains pure refrigerant 12 (plus a certain amount of refrigeration oil which mixes with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will change the pressure-temperature relationship of the refrigerant. The system will no longer operate at the proper pressures and temperatures, and the efficiency of the system will decrease.

The following general practices should be observed to insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant connection, wipe away any dirt or oil at or near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be immediately capped or plugged to prevent the entrance of dirt, moisture, or foreign material. All air contains moisture. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly.

2. Tools should be kept clean and dry. This includes the Charging Station and the Gage Set.

3. When adding oil, the container and the transfer tube through which the oil will flow should be excep-

tionally clean and dry in order to keep the refrigeration oil as moisture-free as possible. For this reason, the oil container should not be opened until ready for use, and should be capped immediately after use.

4. When it is necessary to open a system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the system open any longer than is necessary.

5. Any time the system has been opened and sealed again, it must be properly evacuated, as described in Note 49.

CAUTION: Use only refrigerant from a reputable dealer, as contaminated refrigerant will not only lower the efficiency of the system, but may damage the unit. Use only refrigerant 12 for the Cadillac system, since any other refrigerant may damage the compressor or other parts by incorrect pressure-temperature relationship.

b. Precautions in Handling Refrigerant

Refrigerant 12 is stored and shipped as a liquid under pressure (in metal containers of various sizes and weights).

WARNING: IN HANDLING REFRIGERANT DRUMS, ALWAYS OBSERVE THE FOLLOWING SAFETY PRECAUTIONS:

1. DO NOT LEAVE DRUM UPCAPPED IF DRUM IS SO EQUIPPED. THE METAL CAP FURNISHED WITH THE DRUM WHEN IT IS SHIPPED IS TO PROTECT THE VALVE IN CASE THE DRUM IS ACCIDENTALLY KNOCKED OVER. THIS ELIMINATES THE POSSIBLITY OF THE DRUM FLYING THROUGH THE SHOP AND CAUSING SERIOUS DAMAGE TO PEOPLE AND PROPERTY. A SAFETY PLUG IS PROVIDED ON THE VALVE IN CASE THE TEMPERATURE EXCEEDS THE SAFE LIMITS OF THE DRUM. THE CAP IS DESIGNED SO THAT IF THE SAFETY PLUG AT THE VALVE SHOULD BLOW, THE REFRIGERANT WILL ESCAPE WITHOUT CAUSING THE DRUM TO MOVE.

2. DO NOT OVERFILL DRUM. A SAFETY PLUG IS PROVIDED IN CASE THE TEMPERATURE OF THE REFRIGERANT EXCEEDS THE SAFE LIMITS OF THE DRUM. HOWEVER, IF THE DRUM IS OVERFILLED, THE PRESSURE CREATED COULD CAUSE THE DRUM TO EXPLODE BEFORE THE TEMPERATURE RISES TO THE POINT WHERE THE SAFETY PLUG WOULD BURST AND ALLOW THE REFRIGERANT TO ESCAPE.

3. DO NOT CARRY THE DRUM IN THE PASSENGER COMPARTMENT OF A CAR. ALWAYS PLACE DRUM IN THE LUGGAGE COMPARTMENT OF CAR. IF A DRUM IS CARRIED IN AN OPEN TRUCK SHIELD IT FOR PROTECTION FROM THE SUN'S RAYS. THIS HEAT COULD INCREASE THE PRESSURE ENOUGH TO CAUSE SAFETY PLUG TO BURST.

4. DO NOT SUBJECT DRUM TO HIGH TEMPERATURE WHEN CHARGING SYSTEM – USE WATER NO WARMER THAN 125°F TO HEAT DRUM. NEVER PLACE DRUM ON STEAM RADIATOR OR STOVE, OR USE TORCHES FOR HEATING DURING CHARGING.

5. DO NOT DISCHARGE REFRIGERANT 12 INTO AREAS WHERE THERE IS AN EXPOSED FLAME OR WHERE IT COULD BE DRAWN INTO THE ENGINE AIR INTAKE WHEN THE ENGINE IS OPERATING. CONCENTRATIONS OF THIS GAS IN CONTACT WITH A FLAME MAY PRODUCE A POISONOUS GAS.

6. ALWAYS WEAR GOGGLES WHEN DOING WORK THAT INVOLVES OPENING THE REFRIGERANT LINES. AN ACCIDENT CAN EASILY CAUSE LIQUID REFRIGERANT TO STRIKE THE FACE. IF GOGGLES PROTECT THE EYES, THE LIKELIHOOD OF SERIOUS INJURY WILL BE REDUCED. SHOULD THE LIQUIFIED REFRIGERANT COME IN CONTACT WITH THE EYES, THE PERSON SUFFERING THE INJURY SHOULD IMMEDIATELY HAVE THE EYES IRRIGATED WITH COPIOUS AMOUNTS OF COOL, CLEAN, WATER. AVOID RUBBING OR FURTHER IRRITATION OF THE EYES. THE PERSON SHOULD THEN BE TAKEN TO A QUALIFIED PHYSICIAN FOR EVALUATION.

FOR TREATMENT TO "FROST BITTEN" OR "FROZEN" SKIN DUE TO CONTACT WITH LIQUID REFRIGERANT, PROCEED AS FOLLOWS:

a. RAPID REWARMING OF AFFECTED AREAS BY MOIST HEAT. IMMERSE THE PART OR PARTS IN WATER AND MAINTAIN THE WATER TEMPERATURE BETWEEN 88°F. TO 100°F.

b. AFTER REWARMING PROCESS THE EXPOSURE OF THE PART TO ROOM AIR TEMPERATURE IS PERMISSABLE:

c. THE PERSON CAN THEN BE TAKEN TO A QUALIFIED PHYSICIAN FOR FURTHER EVALUATION.

d. TWO IMPORTANT THINGS TO REMEMBER:

1. <u>DO NOT</u> RUB OR COMPRESS THE AFFECTED PART WITH ICE, SNOW OR COLD WATER. MASSAGE OR FRICTION OF ANY TYPE IS HARMFUL TO FROZEN TISSUE.

2. DO NOT APPLY PRESSURE DRESSINGS OR OINTMENTS OF ANY TYPE.

c. Welding

Excessive heat applied to any section of the refrigerant lines will create excessively high pressures. For this reason, welding should not be performed on any portion of the car adjacent to the refrigerant units or lines.

d. Undercoating

To simplify service operations, undercoating should not be applied to any connections or rubber lines of the refrigeration system. While it is permissible to undercoat the metal refrigerant lines, all flare joints and connections should first be masked.

e. Collision Service

It is very important that the air conditioning system be inspected as soon as possible whenever a car so equipped has been involved in a collision. If the system has been opened as the result of a collision, it will permit the entry of air, moisture, and dirt that will cause internal damage. As the length of time the system has been open and the extent of damage to the components will govern the replacement of parts and the service operations required, a definite procedure cannot be recommended to cover all cases. The following, however, may be used as a guide:

1. Make certain clutch is disengaged, if car is to be operated before repairs are made.
2. Inspect all units and lines, noting any damage.

a. If condenser is damaged it should be replaced. No repairs such as soldering, brazing or welding should be attempted.

b. Replace desiccant bag if system was open for any period of time (See Note 12).

3. Check compressor and clutch pulley for cracks. If compressor does not show evidence of external damage, it may be used.

f. Handling Components

1. Lines should be kept sealed and dehydrated in stock. Do not remove shipping caps from lines until just before installation.
2. Always use two wrenches when tightening fittings to prevent twisting the hoses or soft aluminum tubing. Lubricate all fittings with refrigeration oil to allow the joint to be tightened without twisting the pipe.
3. Cap ends of lines that have been disconnected for any reason, to prevent entrance of moisture or dirt.
4. Gage set and lines should be kept clean and free from moisture.
5. Do not leave refrigeration oil container open any longer than necessary, as the special oil is moisture-free, but will rapidly absorb moisture from the air.
6. Use Vacuum Pump, J-5428, or Charging Station, J-23500, to remove any air or moisture that may have entered the system when it was opened to replace a part.

g. Replacing Components

When removing any components or lines from the system, they must be capped and plugged immediately to prevent exposing them to moisture.

All components of the air conditioning system are shipped dehydrated and sealed. They are to remain sealed until just prior to making connections and should be at room temperature before uncapping to prevent condensation of moisture from the air that enters the components. They should not be uncapped any longer than necessary to make a connection.

All precautions should be taken to prevent damage to the fitting and connections. Any fittings with grease or dirt on them should be cleaned prior to assembly, using a clean cloth dipped in alcohol. If dirt, grease or moisture gets inside lines and cannot be removed, lines must be replaced.

All blue O-rings for making closures for shipment should be discarded and new black O-rings used for making final refrigerant connections.

Use a small amount of refrigerant oil on all tubes and hose joints and lubricate the O-rings with this oil before assembly. Always slip the lubricated O-ring onto the flange tube to insure proper locating and sealing.

All O-ring connections should be tightened with torque wrenches and a crowfoot wrench (used at a 90° angle to the torque wrench for accurate reading), in accordance with the table on Page 1-81. Note that the torque specified for aluminum tubing is less than that specified for steel tubing.

If a connection is made with steel to aluminum, use torques for aluminum. In other words, use the lower torque specifications. Use steel torques only when both ends of connection are steel.

Backing wrenches of the required size must be used during the final tightening of all O-ring and flare-type connections.

Pre-formed refrigeration system lines are not serviced; however, bulk tubing is available along with a selection of fittings so that a replacement hose may be assembled. Drawings (such as Fig. 1-83) are included several places in this service manual showing the routing and attachment of these lines. When assembling refrigerant lines extreme care is required to prevent dirt, rubber chips, etc. from entering the system. A short blast of refrigerant is recommended to clear the hose of contamination. Hoses may be lubricated with refrigeration oil to aid in assembly.

47. Maintenance and Inspection

The following items should be checked every spring and fall and whenever the car is brought in to check the air conditioning.

a. Functional Test of the Air Conditioning

See Note 52 to perform the test.

b. Sight Glass Check

Check VIR sight glass for full charge of refrigerant. If system is low, leak test and make necessary repairs. See Note 50.

(NOTE: It is normal for some foaming to occur in the sight glass with an outside air temperature of 70°F. or below.)

c. Leaks

If there is evidence of oil leaks, leak test entire system and make necessary repairs. See Note 50.

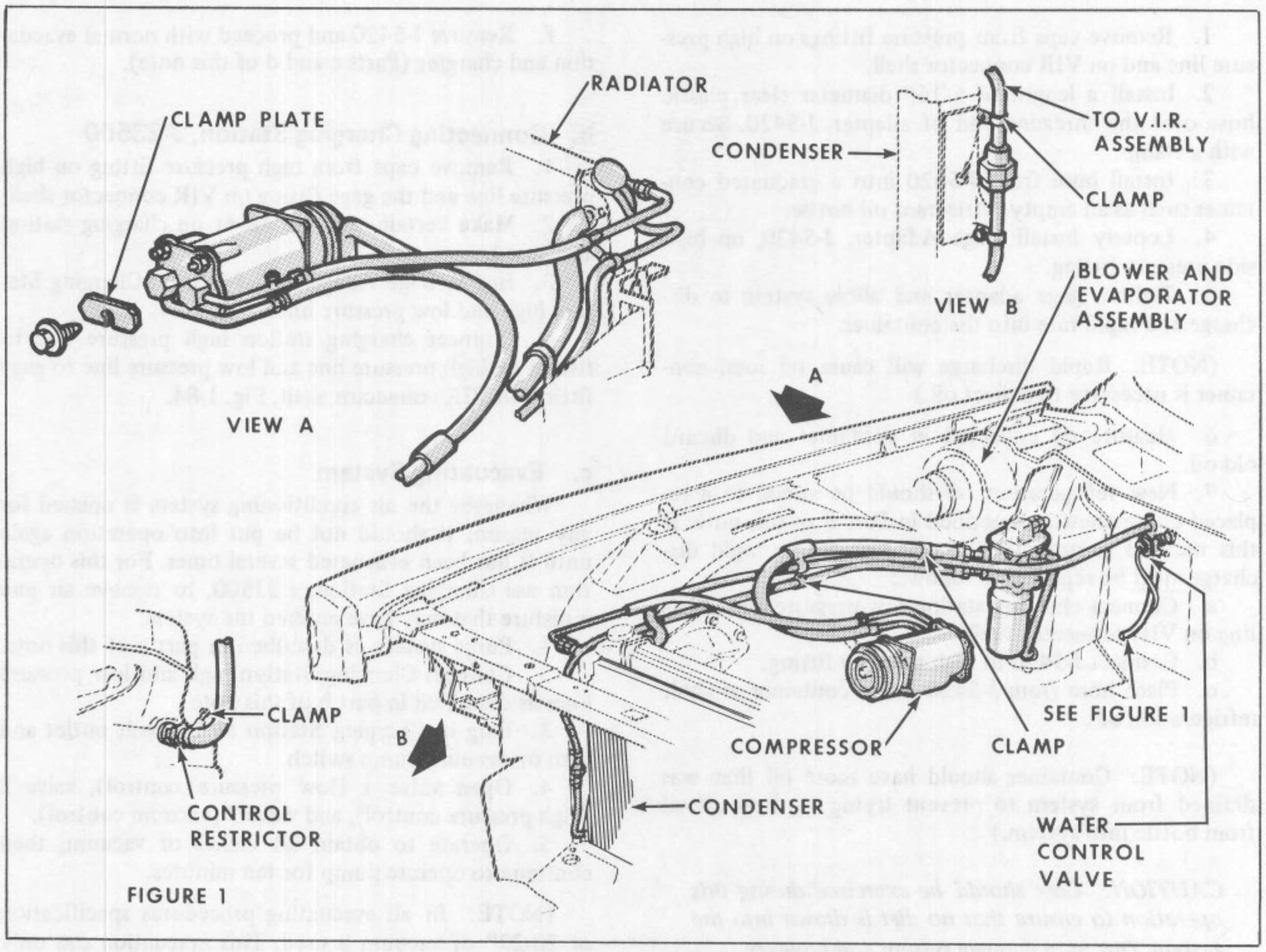


Fig. 1-83 Refrigerant Hose Routing

d. Coolant Level

Check coolant for proper level as described in Section 6, Note 3.

e. Belt Tension

Check tension of belts as described in Section 6, Note 10.

f. Compressor Clutch

Observe clutch to make certain it is engaging and disengaging while moving the selector lever between VENT and LO with the engine idling.

48. Checking Refrigerant Charge

Bubbles in the sight glass do not always indicate that the system is low on refrigerant. If the system is at a control point, bubbles may appear in the sight glass even though the system is fully charged.

A certain amount of foaming is also normal with an outside air temperature of 70°F. or below.

Check refrigerant charge at the sight glass and proceed as described below to make certain that system is not at bubble producing control point.

1. Connect Charging Station low pressure line to gage fitting on VIR connector shell, Fig. 1-84.
2. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.
3. Run engine at 1500 rpm for 5 to 7 minutes to stabilize system.
4. Observe low pressure reading. Low pressure gage should read approximately 29.5 ± .5 pounds.
5. Slow down engine.
6. Maintain engine speed at this level, wait several minutes and then observe sight glass in VIR assembly.

a. If a solid column of refrigerant appears in sight glass, it is an indication that charge in system is adequate or overcharged.

b. If bubbles appear in sight glass, it is an indication that system is low on refrigerant. Add refrigerant to system as described in Note 49.

49. Purging, Evacuating and Charging the Refrigeration System

a. Purging Refrigerant From System

When replacing any air conditioner component, the system must be purged (drained) of refrigerant. The purpose is to lower pressure inside the system so that a component part can be safely removed. Following is a simplified procedure for purging refrigerant from system.

WARNING: ALWAYS WEAR GOGGLES FOR EYE PROTECTION WHEN DOING WORK THAT INVOLVES OPENING THE REFRIGERATION SYSTEM.

1. Remove caps from pressure fittings on high pressure line and on VIR connector shell.
2. Install a length of 5/16" diameter clear plastic hose over the threaded end of adapter, J-5420. Secure with a clamp.
3. Install hose from J-5420 into a graduated container such as an empty refrigerant oil bottle.
4. Loosely install Gage Adapter, J-5420, on high side pressure fitting.
5. Tighten gage adapter and allow system to discharge at a rapid rate into the container.

(NOTE: Rapid discharge will cause oil loss; container is necessary to collect oil.)

6. Measure oil collected in container and discard old oil.
7. New refrigeration oil should be added to a replaced component as described in Part F of this note. If this method is not practical, oil lost during rapid discharge must be replaced as follows:

a. Connect charging station low pressure line to fitting on VIR connector shell.
b. Connect J-5420 to high pressure fitting.
c. Place hose from J-5420 into a container of fresh refrigeration oil.

(NOTE: Container should have more oil than was drained from system to prevent trying to draw all oil from bottle into system.)

CAUTION: Care should be exercised during this operation to ensure that no dirt is drawn into the system. Dirt may damage system components.

d. Start vacuum pump and draw into system as much oil as was lost during rapid discharge. Remove hose from container when this point is reached.

e. Elevate hose to allow oil in hose to be drawn into system.

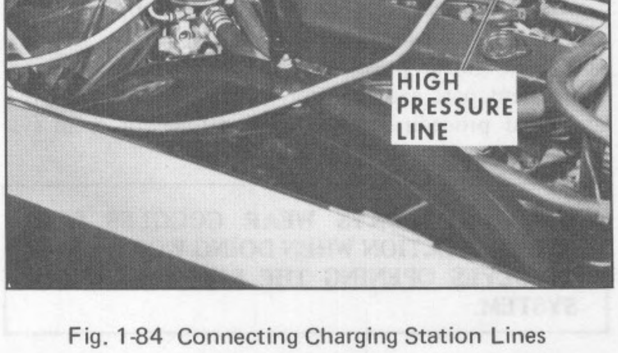


Fig. 1-84 Connecting Charging Station Lines

f. Remove J-5420 and proceed with normal evacuation and charging (Parts c and d of this note).

b. Connecting Charging Station, J-23500

1. Remove caps from high pressure fitting on high pressure line and the gage fitting on VIR connector shell.
2. Make certain that all valves on charging station are closed.
3. Install Gage Adapters, J-5420, on Charging Station high and low pressure lines.
4. Connect charging station high pressure line to fitting on high pressure line and low pressure line to gage fitting on VIR connector shell, Fig. 1-84.

c. Evacuating System

Whenever the air conditioning system is opened for any reason, it should not be put into operation again until it has been evacuated several times. For this operation use Charging Station, J-23500, to remove air and moisture that may have entered the system.

1. Purge system as described in part a of this note.
2. Connect Charging Station high and low pressure lines as described in part b of this note.
3. Plug in Charging Station to 110 volt outlet and turn on vacuum pump switch.
4. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 3 (vacuum control).
5. Operate to obtain 28 inches of vacuum, then continue to operate pump for ten minutes.

(NOTE: In all evacuating procedures specification of 28-29" of vacuum is used. This evacuation can only be attained at or near sea level. For each 1000 feet above sea level where this operation is being performed, specification should be lowered by one inch of mercury vacuum. At 5000 feet elevation only 28" to 24" of vacuum can normally be obtained.)

6. While evacuating the system, add refrigerant to cylinder on Charging Station by opening valves on refrigerant drum and at bottom of cylinder (valve 4 must be closed). Open valve on top of cylinder until proper liquid level is obtained in sight tube, and then close both top and bottom valves on cylinder.
7. Close valves 1, 2 and 3 and turn off vacuum pump switch. System should hold vacuum, unless there is a leak.
8. Slowly open valves 2 and 4, allowing 1/2 to 1 lbs. of refrigerant to enter system, then close valves.

(NOTE: It is advisable at this time to leak test system for major leaks as described in Note 50.)

9. Purge system.
10. Repeat steps 4 and 5.
11. Repeat step 7.
12. System is now ready for complete charge of refrigerant.

d. Adding Refrigerant (Complete Charge)

1. Connect heating element plug to a 110 volt outlet.

2. Disconnect refrigerant detection system at fuse and install jumper wire between "B" and "C" terminals of wiring harness.

3. Evacuate system as described in part c of this note. The system must be properly evacuated.

4. Fill cylinder on Charging Station with refrigerant as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level (3-3/4 pounds on all except 75 Series. 5 pounds on 75 Series.) is obtained in sight tube.

5. Fully open valves 2 and 4 to allow refrigerant to flow into system.

(NOTE: If refrigerant does not flow freely into system, it is probably due to valve cores in high pressure line and VIR fittings not being depressed far enough. If this condition exists, try another Gage Adapter, J-5420, or build up an adapter depressor tongue with solder to depress valve core further.)

6. After liquid refrigerant has stopped flowing into high pressure side of system, close valve 2.

7. Start engine and run at approximately 1500 rpm with transmission in PARK position.

8. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

9. Open valve 1 (valve 4 must also be open). This will allow refrigerant remaining in cylinder to be pulled into system.

10. Shut off engine, close all valves, disconnect Charging Station high and low pressure lines and replace caps on fittings.

11. Remove jumper wire and reconnect thermal fuse.

12. The system should never be overcharged because excessive head pressures result.

e. Adding Refrigerant (Partial Charge)

Refrigerant can be added to the air conditioning system using Charging Station, J-23500. The charging lines must be purged before any refrigerant is added.

1. Connect Charging Station as described in part b of this note.

(NOTE: Purge air from Charging Station high and low pressure lines before connecting. To purge lines, crack open valves 1, 2 and 4, making certain that there is some refrigerant in cylinder, then install lines and close valves.)

2. Disconnect refrigerant flow detection system at fuse and install jumper wire between "B" and "C" terminals of wiring harness.

3. Operate engine at 600 rpm with transmission in PARK position.

4. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

5. Fill cylinder on Charging Station with 2 to 3 pounds of refrigerant, as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube.

c. Close valve at bottom of cylinder.

6. Open valves 1 and 4. Watch sight glass until solid column of liquid appears, then close valves.

(NOTE: It is normal for some foaming to occur in sight glass with outside air temperature at 70°F or below. See Note 48.)

7. After five minutes of operation, check sight glass again. If no bubbles appear, open valves 1 and 4 and add another 1-1/4 pounds of refrigerant.

(NOTE: The VIR sight glass will clear at approximately 2-1/2 pounds charge — or at 1-1/4 pounds less than full charge.)

8. Shut off engine, close all valves, disconnect Charging Station, and install gage fitting caps.

9. Remove jumper wire and reconnect thermal fuse.

10. The system should not be overcharged due to excessive head pressures that result.

f. Adding Oil

The six-cylinder compressor uses 525 viscosity refrigeration oil. An oil charge of 10-1/2 fluid ounces is required.

It is important that only the specified type and quantity of oil be used in the compressor. If there is a surplus of oil in the system, too much oil will circulate with the refrigerant, causing the cooling capacity of the system to be reduced. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigeration system or when the system is discharged at a rapid rate as described in part a of this note, certain procedures must be followed to assure that the total oil charge in the system is correct when the system is reactivated. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. When the system is discharged at a rapid rate or a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by adding oil to the new replacement part.

The procedures for adding oil are as follows:

1. Compressor Only

1. Idle engine for 10 minutes at 1000 – 1500 rpm at maximum cooling and high blower speed to allow oil to distribute itself in system in a normal manner.

2. Remove compressor from car and place it in a horizontal position with drain plug downward. Drain oil, measure, and discard it.

3. Drain oil from compressor that is to be installed in car.

4. If oil drained in step 2 is more than 4 fluid ounces, add to the new compressor the same amount of oil as drained from replaced unit plus the amount lost during rapid discharge.

5. If the oil drained in step 2 is less than 4 fluid ounces, add 6 ounces of oil to new compressor, plus the amount lost during rapid discharge.

2. Replacing Components

Whenever replacing a component of the air conditioning system, measured quantities of 525 viscosity refrigeration oil should be added to the component to assure that total oil charge in system is correct before unit is operated.

Oil should be added to replacement components as indicated below.

Evaporator (front or rear)	Add 3 fluid ozs.*
Condenser	Add 1 fluid oz.*
Receiver	Add 1 fluid oz.*
Condenser and Receiver Assembly	Add 2 fluid ozs.*

"*Plus the amount lost during rapid discharge.

Oil should be poured directly into the replacement component. If an evaporator is installed, pour oil into inlet pipe with pipe held vertically so oil will drain into core.

If any other components, such as valves or hoses are replaced, no additional oil is necessary.

3. Compressor and Components

CAUTION: If system has been operated and there is evidence of a major loss of oil, system has probably lost all or most of its refrigerant. If any refrigerant remains, discharge it from system. Do not operate compressor any more than is absolutely necessary to avoid damage from lack of oil.

1. Remove compressor and place in a horizontal position with drain plug downward. Drain oil from compressor, measure it and then discard it. To promote draining, have suction connector open and tilt compressor as required.

2. Replace damaged component from which the oil was lost.

3. If more than 4 fluid ounces of oil was drained from compressor in step 1, add same amount of new oil to compressor, plus an amount to compensate for that in damaged component, as shown in the table.

4. If less than 4 fluid ounces of oil was drained from compressor in step 1, add 6 fluid ounces of oil, plus amount shown in the table for component being replaced.

50. Leak Testing Refrigeration System

There are three methods that may be used for detecting leaks in the air conditioning system. The use of a leak detector fluid, a torch type leak detector or an electronic leak detector.

a. Leak Detector Fluid

Leak detector fluid (mixed with water per directions on bottle) may be used by daubing or squirting the liquid around joints to be tested. Ordinary leaks will form a cluster of bubbles almost immediately. Extremely small leaks will form a white foam which will materialize with a time limit from a few seconds to a minute, depending on size of leak.

In order to locate leaks with this fluid, it is essential that you see all of the surfaces you are checking with a good light; otherwise small leaks could easily be overlooked.

b. Torch Type Leak Detector

Detecting a leak with the torch type detector is accomplished by observing the color of the flame in the head of the detector, when the sampling tube is close to a refrigerant leak.

The flame can be described as three different colors: green, blue, and purple. Green indicates a small leak, blue indicates a medium leak and purple indicates a large leak.

WARNING: WHEN LEAK TESTING, AVOID INHALING FUMES OR GAS FROM DETECTOR TORCH. THEY MAY BE TOXIC AND CAUSE DAMAGE TO THE LUNGS IF INHALED. IT IS ALSO RECOMMENDED THAT A FIRE EXTINGUISHER BE CLOSE AT HAND WHEN USING THE LEAK DETECTOR TORCH.

To operate unit, open valve until a low hiss of gas is heard, then light the flame at opening in detector chimney. Adjust flame until blue flame is approximately 3/8 inches above reaction plate to make detector as sensitive as possible for small leaks.

When checking for leaks, always position sampling tube below fitting or area to be tested, as refrigerant 12 is a heavy vapor and will sink when exposed to air.

It is best to test low pressure side of system at drum pressure which is much higher than normal low side operating pressure.

In testing high pressure side for leaks, run system for a few minutes to build up pressure in high pressure side of system. Then stop engine and test high pressure side of system for leaks.

Do not attempt to leak test with the engine running or in a drafty location as it will disperse the refrigerant 12 and be impossible to locate a leak.

c. Electronic Leak Detector

Two types of electronic leak detectors are recommended: the more recently available Refrigerant Gun, J-23400; and Electronic Leak Detector, J-22235. Instructions for their use are included with the equipment.

51. Cooling Capacity Performance Test

The following procedures pertain to all models except Fleetwood Seventy-Five. Performance Tests for the Fleetwood Seventy-Five Air Conditioning Systems are explained in Note 55.

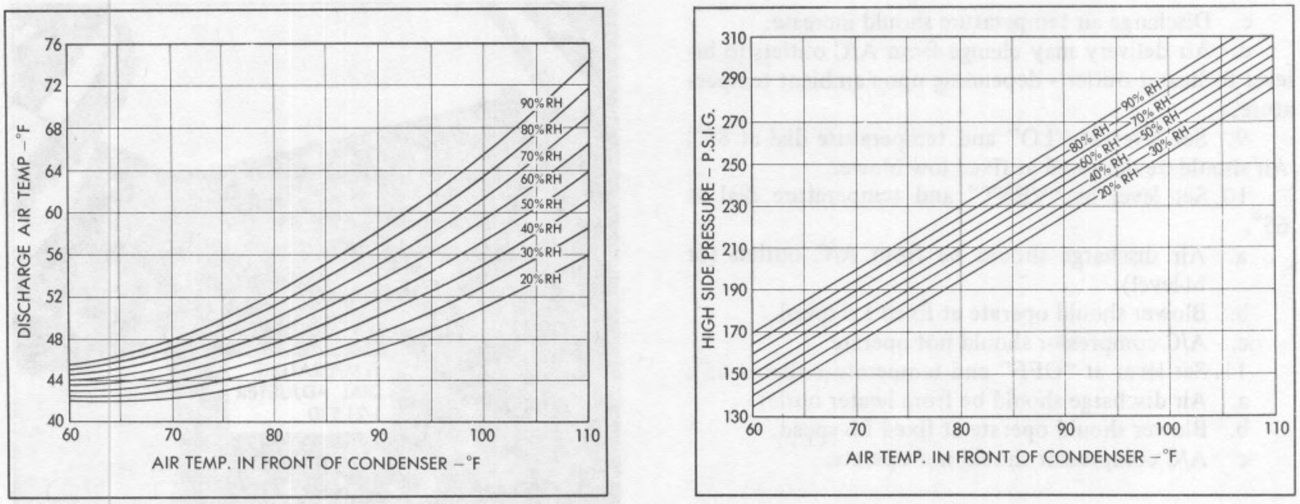


Fig. 1-85 A/C Performance Test (Except 75 Rear)

a. Performing Test

1. Connect gage set high and low pressure lines, Fig. 1-84.
2. Hook up tachometer.
3. Connect Tester J-23678 using Adapter Harness J-24774 and set tester for max. A/C.
4. Locate auxiliary fan 24" in front of condenser (12" in front of grille).
5. Place humidicator, J-6076, in auxiliary fan air stream in front of car.
6. Open both front doors.
7. Open all A/C outlets.
8. Insert a calibrated thermometer in righthand outlet, (J-22555).

(NOTE: Sensing bulb should not touch metal or plastic.)

9. Set A/C control lever to "Auto".
10. Place shift lever in "Park" and apply parking brake.
11. Start engine and set to run at 2,000 RPM.
12. Lower hood carefully to lowest position possible. Do not pinch or damage gage set hoses.
13. Allow engine to run for 10 minutes.
14. Record readings of:

a. Ambient dry bulb, which gives the temperature in front of the condenser.

b. Ambient wet bulb, which determines the humidity.

c. High and low side pressures.

d. Air temperature at right hand outlet.

b. A/C Test Conclusions

The discharge temperature should agree with the value shown on the Discharge Air Temperature Chart, left side of Fig. 1-85 within ± 3°F.

The high pressure should agree with the value shown on the High Side Pressure Chart within 25 psi, right side of Fig. 1-85.

The low side pressure should be 29.5 ± 5 psig in all cases, except where ambient temperature and humidity are extremely high.

If these conditions are not met, refer to the diagnosis section.

52. Control System Functional Test

The following procedure is used to assure correct functional operation and requires approximately two minutes to perform. The system is to be tested at room temperature with the hood down, the doors and windows closed and the engine operating. Engine coolant must be warm. Proceed as follows:

1. Operate car at 1000 RPM or better.
2. Place A/C outlets in wide-open position.
3. Install thermometer in center A/C outlet.
4. Set control lever at "DEF" and temperature dial at 85°.

a. Air should be delivered out of the defroster outlets.

b. Blower should operate at high speed.

c. Some air should come out heater outlet.

5. Set lever at "BI-LEVEL" and temperature dial at 75°.

a. Air should be delivered from both the A/C and heater outlets.

b. Blower should operate at a lower speed.

c. Small airflow should come from defroster outlets.

6. Set lever at "HI" and temperature dial at 65°.

a. Cool to cold air should be delivered from A/C outlets.

b. Blower should operate at high speed.

c. Recirc air door should open (will be slightly noisy).

7. Set lever at "AUTO" and temperature dial at 65°. After 45 seconds, discharge air temperature should be 50°F or lower (may be slightly higher in 90°F or above ambient).

8. Set lever at "AUTO" and temperature dial at 85°.

a. Blower speeds should drop (Hi - M_3 - M_2 - M_1 - etc.)

b. Recirc door should close – noise level will drop.

c. Discharge air temperature should increase.

d. Air delivery may change from A/C outlets to bi-level to heater outlet - depending upon ambient temperature.

9. Set lever at "LO" and temperature dial at 85°. Air should be delivered at fixed low blower.

10. Set lever at "VENT" and temperature dial at 65°.

a. Air discharge should be from A/C outlets (or bi-level).

b. Blower should operate at fixed Lo speed.

c. A/C compressor should not operate.

11. Set lever at "OFF" and temperature dial at 65°.

a. Air discharge should be from heater outlet.

b. Blower should operate at fixed Lo speed.

c. A/C compressor should not operate.

53. Component Adjustments

Be sure to allow sufficient time for the car engine to "warm up" and for the system to "turn-on" before attempting calibration. Do not skip any steps in the Calibration Procedure.

a. Temperature Dial Calibration

1. Disconnect electrical connector from programmer and connect appropriate end of harness adapter J-24774 to the programmer and car harness.

2. Connect the ATC Tester J-23678 into the opposite end of Adapter Harness J-24774.

3. Working through opening in top of glove compartment, disconnect in-car sensor electrical connector and connect harness to double connector (black wires) coming out of Adapter Harness J-24774.

4. Place the "MANUAL-AUTOMATIC" switch on the tester in the "MANUAL" position.

5. Place the "TEMPERATURE DIAL CALIBRATOR" switch on the tester in the "CALIBRATE" position.

6. Note the voltmeter reading.

7. Press the "CALIBRATE" button and note the voltmeter reading.

8. With the "CALIBRATE" button pressed in, rotate the temperature dial on the control head until the voltmeter reading is the same as it was in Step 5 (when the button is not pressed in).

9. The temperature dial should be set at 75°. If it is not, use tool #J-21530 to hold the gear on the top of the temperature dial and slip the temperature dial to the correct setting, Fig. 1-86. If the temperature dial cannot be calibrated using this procedure, it is defective.

10. Remove test equipment and make all normal connections. Make sure in-car sensor aspirator hose is properly attached.

b. Mix Door Link Adjustment

1. Loosen the hex screw of the door link at the output shaft of the programmer, Fig. 1-87.

2. Place the control head selector lever in the "DEF" position.

3. Remove the electrical connector from the ambient sensor. This results in the proper position of the output shaft of the programmer (full heat position).

Fig. 1-86 Adjusting Temperature Dial

4. Check to make sure that the air mix door is in the full heat position. The blower air flow will now hold the mix door in the proper position.

5. Without disturbing the door link or the output shaft position, tighten the hex screw on the door link, Fig. 1-87.

6. To check the Mix Door Link Adjustment, proceed as follows.

a. Connect Tester J-23678 into the wiring harness and the programmer using Harness Adapter J-24774. Place the control head in "AUTO". Place the "MANUAL-AUTOMATIC" switch in the "MANUAL" position. Using the "MANUAL CONTROL", swing the programmer to "Max. Heat" then to "Max. Cold". Hi blower should be obtained in both positions.

b. Check for recirculation operation. Operate the system with the "MANUAL CONTROL" on "150" for 5 minutes so the restricted vacuum line can move the outside air door to the outside air position. With the control head in "HI", move the "MANUAL CONTROL" to "Max. Cold". With all the car doors and windows closed, the blower noise level should increase when recirculation occurs (approximately 3 minute delay due to the restrictor).

c. Programmer Amplifier Calibration (Feedback "Pot" Adjustment)

1. Remove the plastic cover from the programmer while it is still mounted in the car.

2. Connect the Tester J-23678 into the wiring harness and the programmer using Harness Adapter J-24774.

3. Place the control head selector lever in the "AUTO" position.

4. Place the "MANUAL-AUTOMATIC" switch on the tester in the "MANUAL" position.

5. Place the "TEMPERATURE DIAL CALIBRATOR" switch of the tester in the "OFF" position.

6. Rotate the "MANUAL CONTROL" knob on the tester to the "Max. Heat" position. The programmer should move to the full heat position.

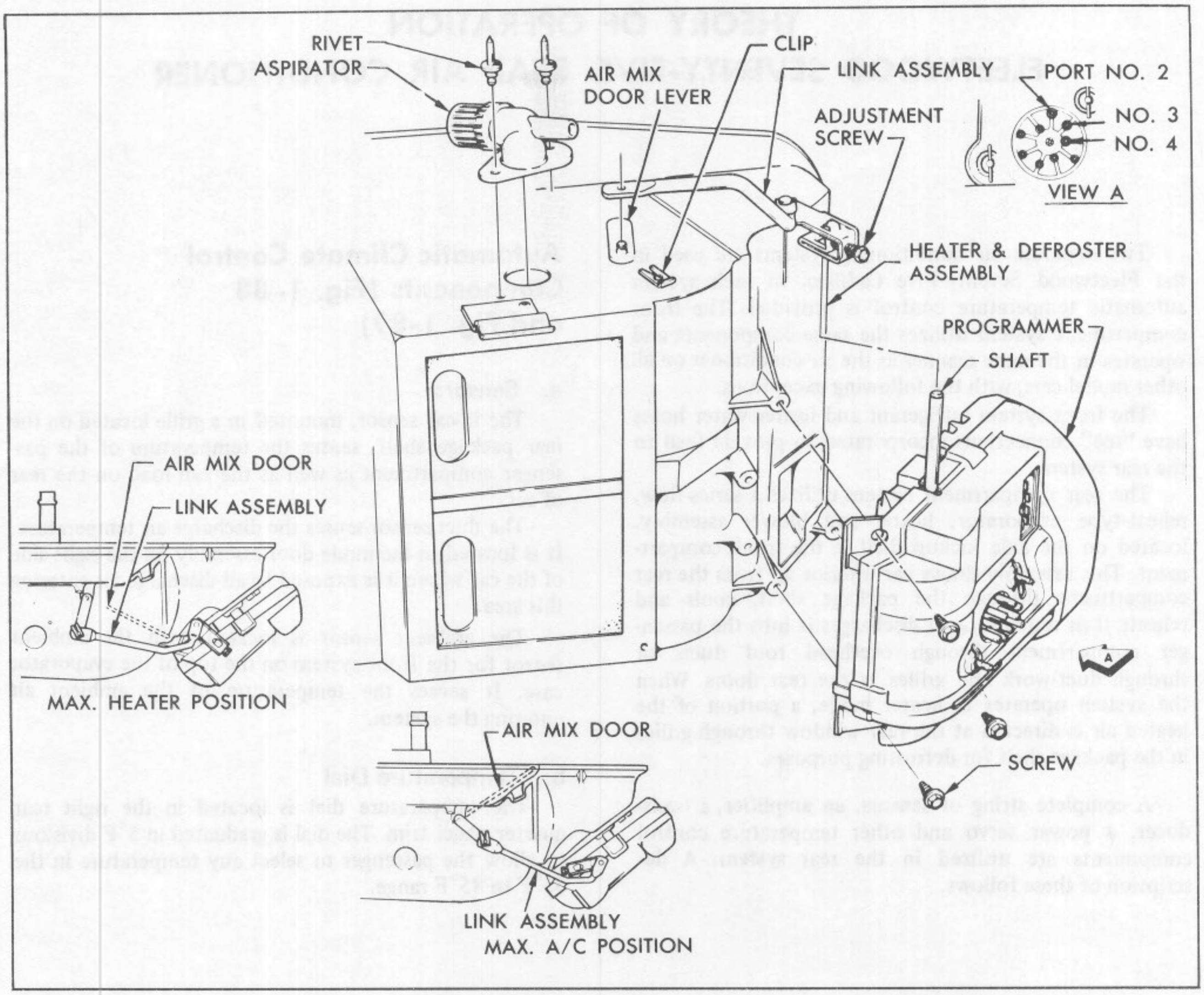


Fig. 1-87 Programmer Installation and Adjustment

7. Rotate the "MANUAL CONTROL" knob to 180 and STOP. DO NOT OVER-TRAVEL!

8. Using a blade type screwdriver, slip the shaft of the feedback potentiometer fully counterclockwise to its stop (see Figure 1-82 for location of the feedback potentiometer in the programmer). The vacuum motor mechanism will be "in" the vacuum motor indicating full heat operation.

9. Using the screwdriver, very slowly slip the feedback potentiometer clockwise until the first movement of the vacuum motor mechanism can be seen. Stop the adjustment when the movement first occurs. (Do not watch the programmer output shaft.)

10. To check the adjustment, rotate the "MANUAL CONTROL" knob to the "Max. Heat" position. Then slowly rotate the "MANUAL CONTROL" knob counterclockwise and the vacuum motor mechanism should first start to move when the "MANUAL CONTROL" knob is exactly at 180 ± 1. Touch up the feedback potentiometer adjustment in the programmer so that the mechanism movement occurs exactly 180. If this adjustment cannot be made, the programmer is defective.

d. Compressor Drive Belt

The compressor drive belt is adjusted at the power steering pump. Follow procedure described in Section 6,Note 10.

TORQUE SPECIFICATIONS METAL TUBING

Metal Tube O.D. (Inch Lbs.)	Steel Tubing Torque (Ft. Lbs.)	Alum. Tubing Torque (Ft. Lbs.*)
1/4"	15	7
3/8"	35	13
1/2"	35	13
5/8"	35	21
3/4"	35	28

*Torque taken with crow foot attachment at a 90° angle on torque wrench.

THEORY OF OPERATION
FLEETWOOD SEVENTY-FIVE REAR AIR CONDITIONER

Two separate air conditioning systems are used in the Fleetwood Seventy-Five Cadillac. In each system automatic temperature control is provided. The front compartment system utilizes the same components and operates in the same manner as the air conditioner on all other model cars, with the following exceptions:

The front system refrigerant and heater water hoses have "tee" connections incorporated to provide feed to the rear system.

The rear compartment system utilizes a series-flow, reheat-type evaporator, heater and blower assembly, located on the axle kickup shelf in the trunk compartment. This assembly draws car interior air from the rear compartment through the package shelf, cools and reheats it as required, and discharges it into the passenger compartment through overhead roof ducts or through duct-work and grilles in the rear doors. When the system operates in heater mode, a portion of the heated air is directed at the rear window through grilles in the package shelf for defrosting purposes.

A complete string of sensors, an amplifier, a transducer, a power servo and other temperature control components are utilized in the rear system. A description of these follows.

Automatic Climate Control Components (Fig. 1-88 and Fig. 1-89)

a. Sensors

The in-car sensor, mounted in a grille located on the rear package shelf, senses the temperature of the passenger compartment as well as the sun load on the rear of car.

The duct sensor senses the discharge air temperature. It is located in the mode door assembly on the right side of the car where it is exposed to all discharge air entering this area.

The ambient sensor is located with the ambient sensor for the front system on the top of the evaporator case. It senses the temperature of the ambient air entering the system.

b. Temperature Dial

The temperature dial is located in the right rear quarter panel trim. The dial is graduated in 5°F divisions to allow the passenger to select any temperature in the 65°F to 85°F range.

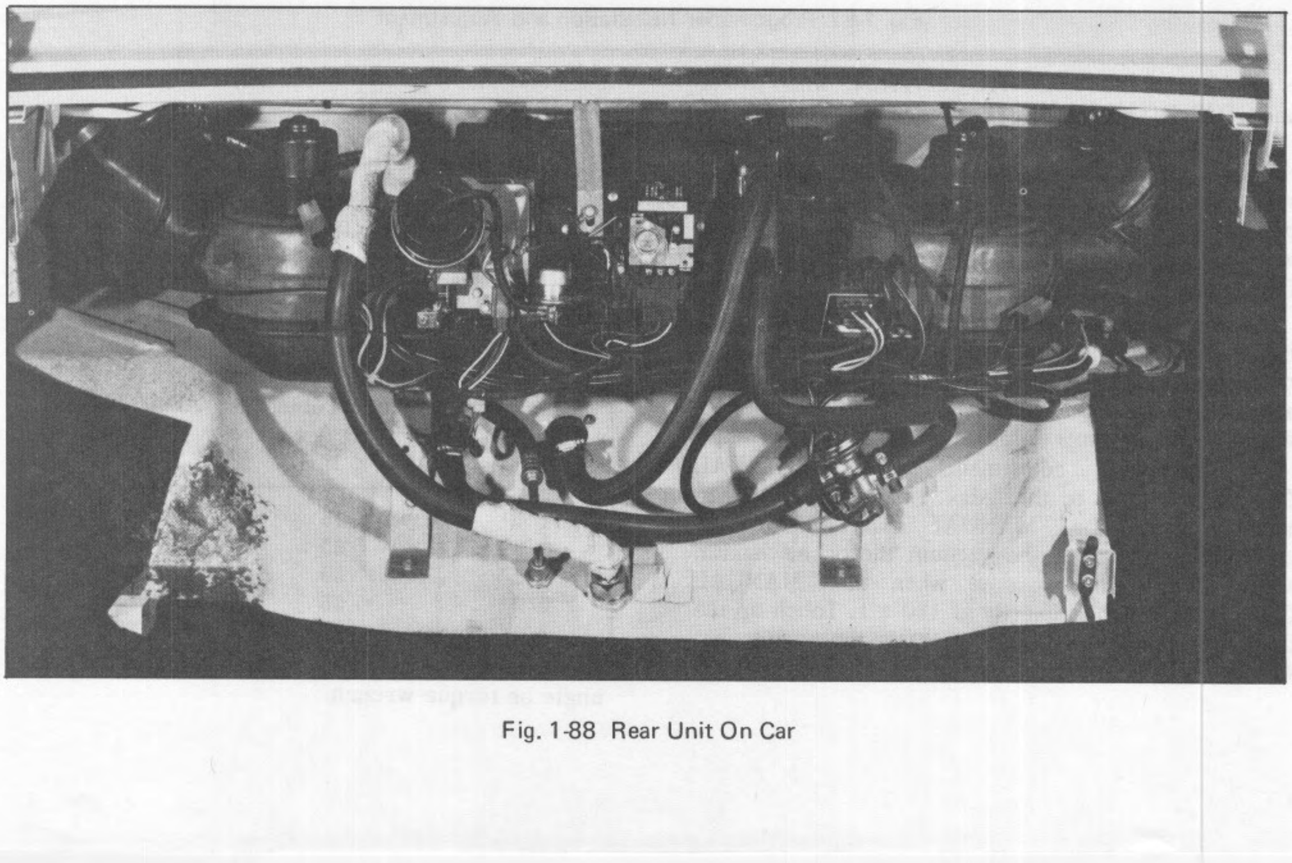


Fig. 1-88 Rear Unit On Car

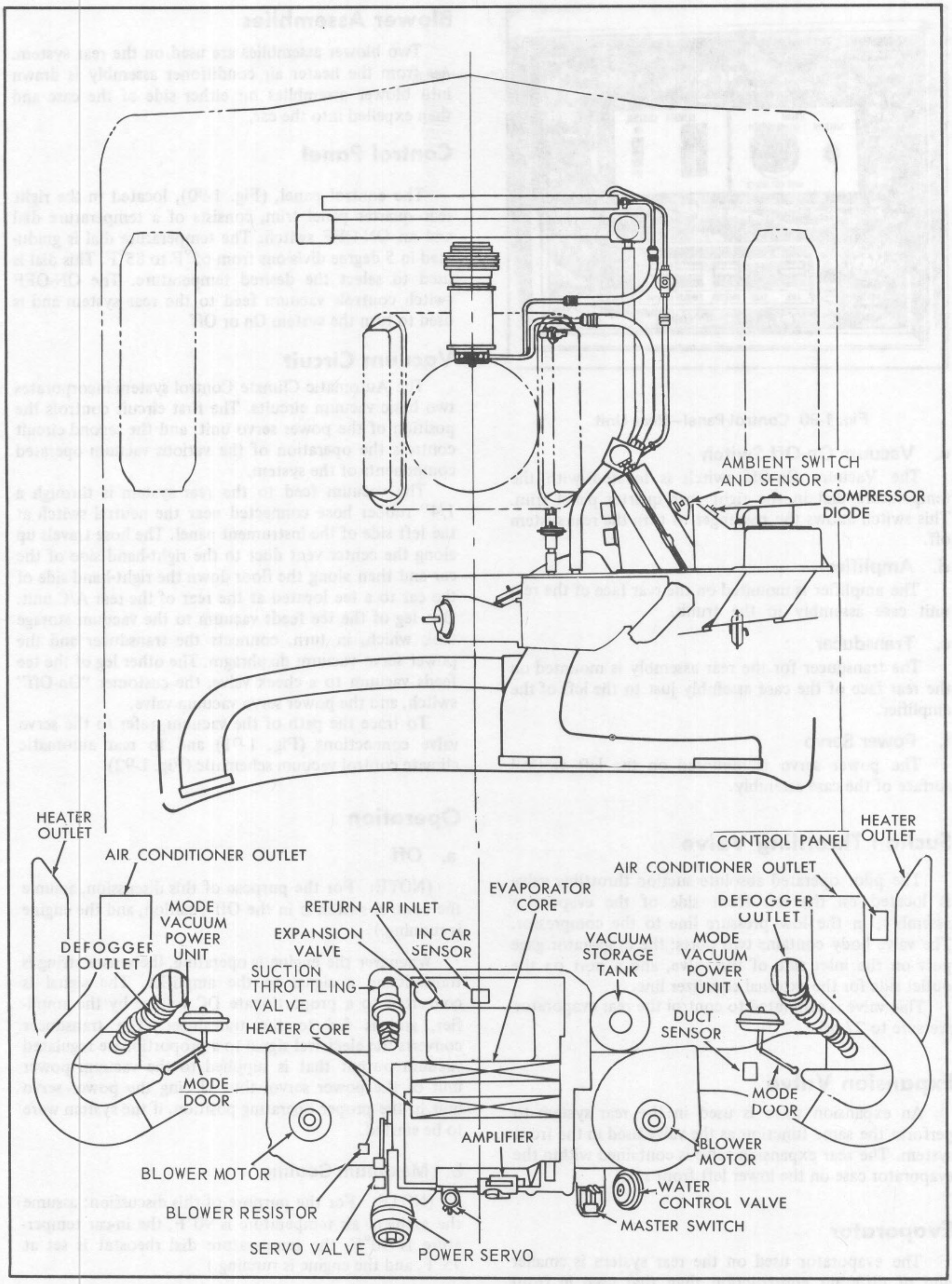


Fig. 1-89 Location of Rear A/C Units

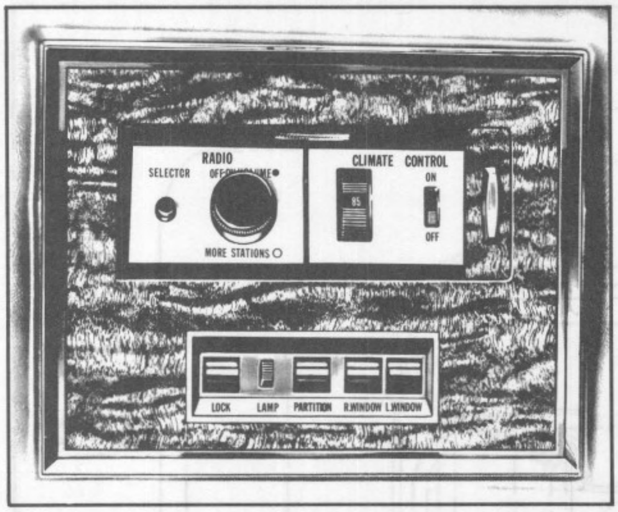


Fig. 1-90 Control Panel—Rear Unit

c. Vacuum On-Off Switch

The Vacuum On-Off switch is located with the temperature dial in the right rear quarter panel trim. This switch allows the passenger to turn the rear system off.

d. Amplifier

The amplifier is mounted on the rear face of the rear unit case assembly in the trunk.

e. Transducer

The transducer for the rear assembly is mounted on the rear face of the case assembly just to the left of the amplifier.

f. Power Servo

The power servo is mounted on the left vertical surface of the case assembly.

Suction Throttling Valve

The pilot operated absolute suction throttling valve is located on the left front side of the evaporator assembly, in the low pressure line to the compressor. The valve body contains two ports; the evaporator gage port on the inlet side of the valve, and a port on the outlet side for the external equalizer line.

This valve is calibrated to control the rear evaporator pressure to 27 psi.

Expansion Valve

An expansion valve is used in the rear system to perform the same function as the valve used in the front system. The rear expansion valve is contained within the evaporator case on the lower left front side.

Evaporator

The evaporator used on the rear system is smaller and of different construction than that used in front systems. The rear evaporator is located in the case assembly in the luggage compartment under the package shelf.

Blower Assemblies

Two blower assemblies are used on the rear system. Air from the heater air conditioner assembly is drawn into blower assemblies on either side of the case and then expelled into the car.

Control Panel

The control panel, (Fig. 1-90), located in the right rear quarter panel trim, consists of a temperature dial and an ON-OFF switch. The temperature dial is graduated in 5 degree divisions from 65°F to 85°F. This dial is used to select the desired temperature. The ON-OFF switch controls vacuum feed to the rear system and is used to turn the system On or Off.

Vacuum Circuit

The Automatic Climate Control system incorporates two basic vacuum circuits. The first circuit controls the position of the power servo unit, and the second circuit controls the operation of the various vacuum operated components of the system.

The vacuum feed to the rear system is through a 1/4" rubber hose connected near the neutral switch at the left side of the instrument panel. The hose travels up along the center vent duct to the right-hand side of the car and then along the floor down the right-hand side of the car to a tee located at the rear of the rear A/C unit. One leg of the tee feeds vacuum to the vacuum storage tank which, in turn, connects the transducer and the power servo vacuum diaphragm. The other leg of the tee feeds vacuum to a check valve, the customer "On-Off" switch, and the power servo vacuum valve.

To trace the path of the vacuum, refer to the servo valve connections (Fig. 1-91) and to rear automatic climate control vacuum schematic (Fig. 1-92).

Operation

a. Off

(NOTE: For the purpose of this discussion, assume the control switch is in the Off position, and the engine is running.)

Whenever the engine is operating, the sensor string is transmitting a signal to the amplifier. The signal is converted to a proportionate DC voltage by the amplifier, and is fed to the transducer. The transducer converts the electrical signal to a proportionate regulated vacuum output that is supplied to the vacuum power unit of the power servo, thus placing the power servo unit in the proper operating position, if the system were to be started.

b. Maximum Cooling

(NOTE: For the purpose of this discussion: assume the ambient air temperature is 90°F, the in-car temperature is 90°F, the temperature dial rheostat is set at 75°F, and the engine is running.)

Due to the high temperatures acting on the sensors, the resistance values of the sensors will be low, causing a

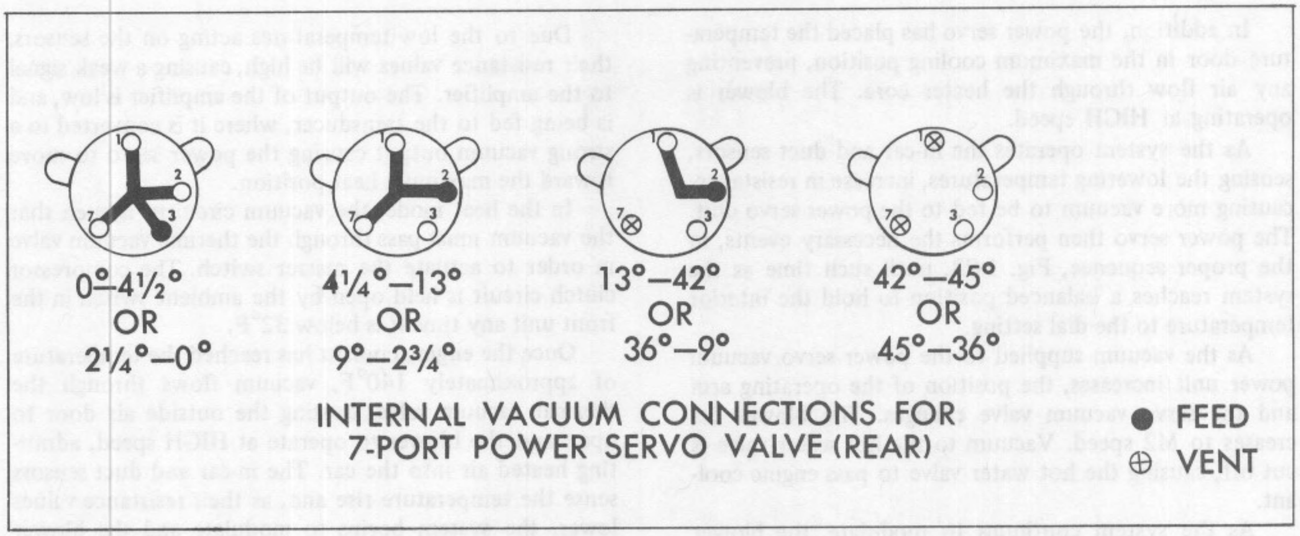


Fig. 1-91 Rotary Valve Internal Connections—75 Series

strong signal to the amplifier. The output of the amplifier is high, and is being fed to the transducer, where it is converted to a weak vacuum output, causing the power servo to be in the maximum air conditioning position.

When the switch is placed in the "ON" position, vacuum is fed to the master switch, completing the electrical circuit to the blower motor and compressor, and to the servo vacuum valve. In the maximum air conditioning position, the servo valve performs the following vacuum functions:

The mode doors are moved to the air conditioning position, allowing the discharge air to be discharged through the air conditioner outlets. The water control valve is closed, preventing the flow of engine coolant to the heater core.

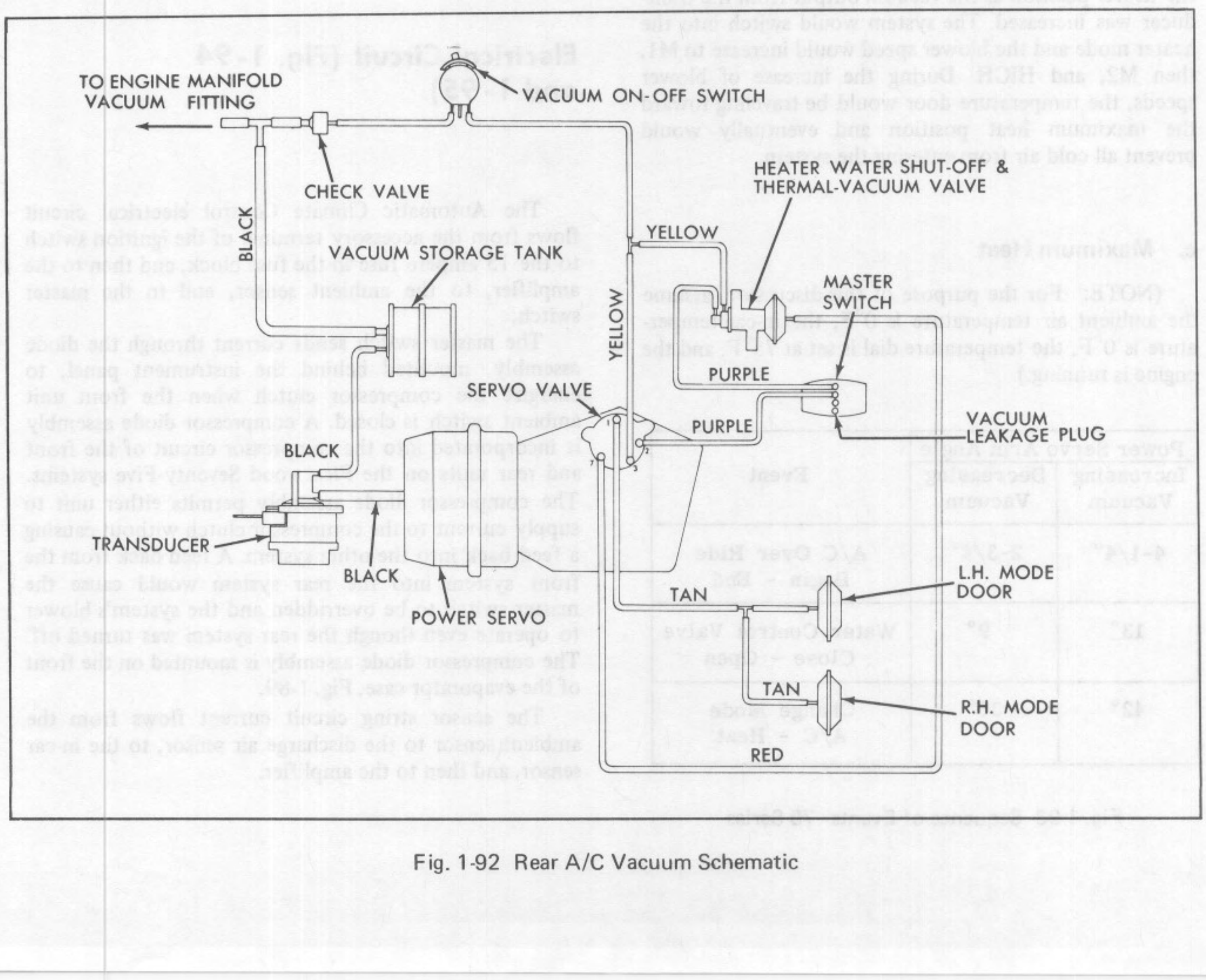


Fig. 1-92 Rear A/C Vacuum Schematic

In addition, the power servo has placed the temperature door in the maximum cooling position, preventing any air flow through the heater core. The blower is operating at HIGH speed.

As the system operates the in-car and duct sensors, sensing the lowering temperatures, increase in resistance, causing more vacuum to be fed to the power servo unit. The power servo then performs the necessary events, in the proper sequence, Fig. 1-93, until such time as the system reaches a balanced position to hold the interior temperature to the dial setting.

As the vacuum supplied to the power servo vacuum power unit increases, the position of the operating arm and the servo vacuum valve changes. The blower decreases to M2 speed. Vacuum to the hot water valve is cut off, causing the hot water valve to pass engine coolant.

As the system continues to modulate, the blower will decrease to M1 speed and then the position of the temperature door will change to allow the entry of heated air that will mix with the cooled air. Continued modulation by the system can decrease the blower to LOW speed. The system will modulate itself to maintain the interior temperature, regardless of any change in the ambient air temperature.

If the ambient air temperature were to fall quite rapidly, the ambient sensor resistance value would increase, causing a weaker voltage signal to be sent to the transducer. The power servo unit would move towards the heater position as the vacuum output from the transducer was increased. The system would switch into the heater mode and the blower speed would increase to M1, then M2, and HIGH. During the increase of blower speeds, the temperature door would be traveling toward the maximum heat position and eventually would prevent all cold air from entering the system.

c. Maximum Heat

(NOTE: For the purpose of this discussion, assume the ambient air temperature is 0°F, the in-car temperature is 0°F, the temperature dial is set at 75°F, and the engine is running.)

Power Servo Arm Angle		Event
Increasing Vacuum	Decreasing Vacuum	
4-1/4°	2-3/4°	A/C Over Ride Begin - End
13°	9°	Water Control Valve Close - Open
42°	36°	Change Mode A/C - Heat

Fig. 1-93 Sequence of Events—75 Series

Due to the low temperatures acting on the sensors, their resistance values will be high, causing a weak signal to the amplifier. The output of the amplifier is low, and is being fed to the transducer, where it is converted to a strong vacuum output causing the power servo to move toward the maximum heat position.

In the heat mode, the vacuum circuitry is such that the vacuum must pass through the thermal vacuum valve in order to actuate the master switch. The compressor clutch circuit is held open by the ambient switch in the front unit any time it is below 32°F.

Once the engine coolant has reached the temperature of approximately 140°F, vacuum flows through the thermal vacuum valve, causing the outside air door to open and the blower to operate at HIGH speed, admitting heated air into the car. The in-car and duct sensors sense the temperature rise and, as their resistance values lower, the system begins to modulate and the blower speeds will diminish to M2, M1 and then to LOW.

During the decrease in blower speeds, the temperature door would travel from the maximum heat position to a mid-position, blending heated and cooled air. If the outside air temperature were to rise to about 35°F, the compressor clutch circuit would close, causing compressor operation to begin. Continued temperature increases, sensed by the sensors, cause the system to move toward the air conditioning position.

Electrical Circuit (Fig. 1-94 and 1-95)

The Automatic Climate Control electrical circuit flows from the accessory terminal of the ignition switch to the 15 ampere fuse in the fuse block, and then to the amplifier, to the ambient sensor, and to the master switch.

The master switch sends current through the diode assembly, mounted behind the instrument panel, to energize the compressor clutch when the front unit ambient switch is closed. A compressor diode assembly is incorporated into the compressor circuit of the front and rear units on the Fleetwood Seventy-Five systems. The compressor diode assembly permits either unit to supply current to the compressor clutch without causing a feed back into the other system. A feed back from the front system into the rear system would cause the master switch to be overridden and the system's blower to operate even though the rear system was turned off. The compressor diode assembly is mounted on the front of the evaporator case, Fig. 1-89.

The sensor string circuit current flows from the ambient sensor to the discharge air sensor, to the in-car sensor, and then to the amplifier.

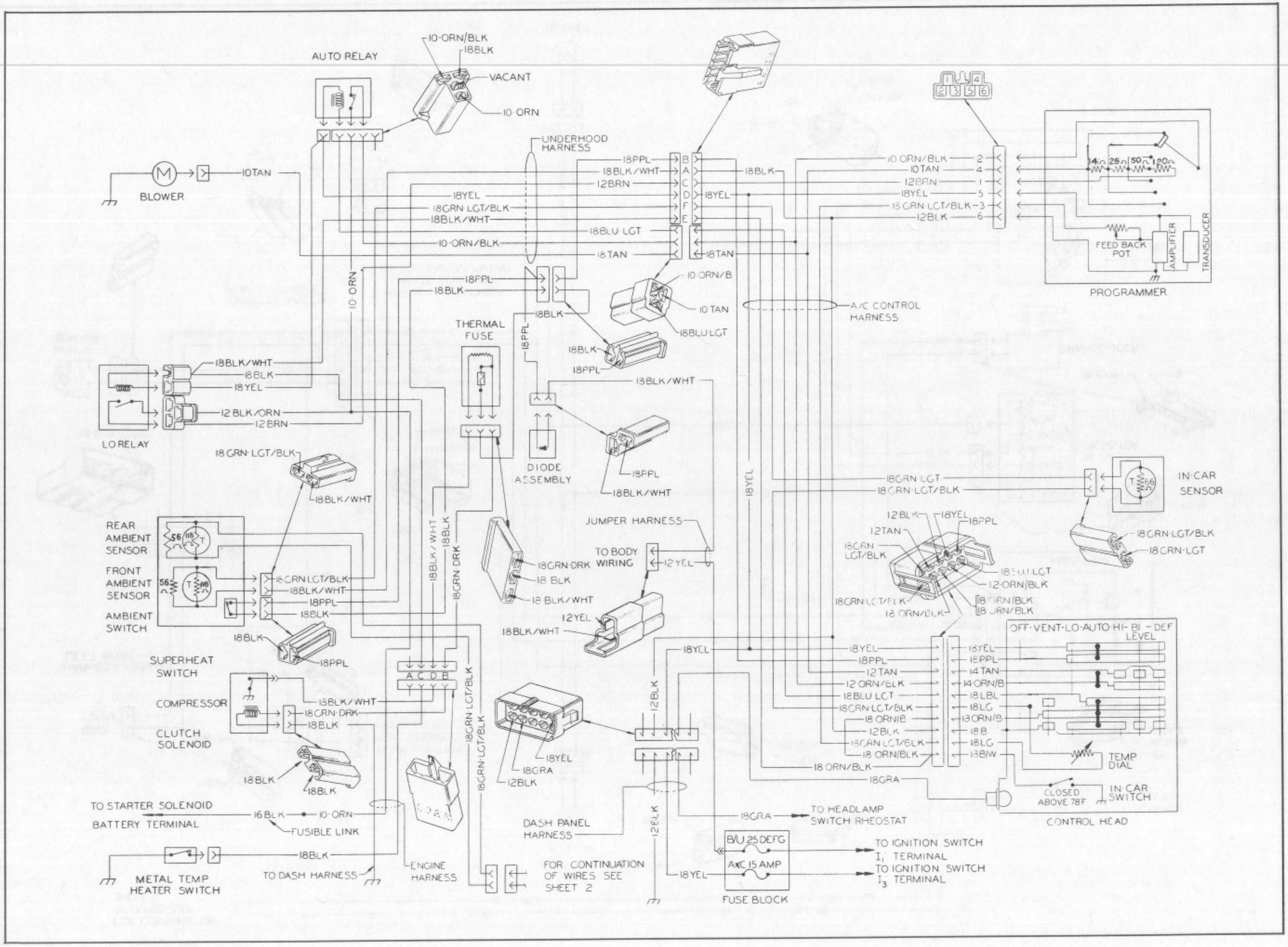


Fig. 1.94 Front A/C Circuit Diagram

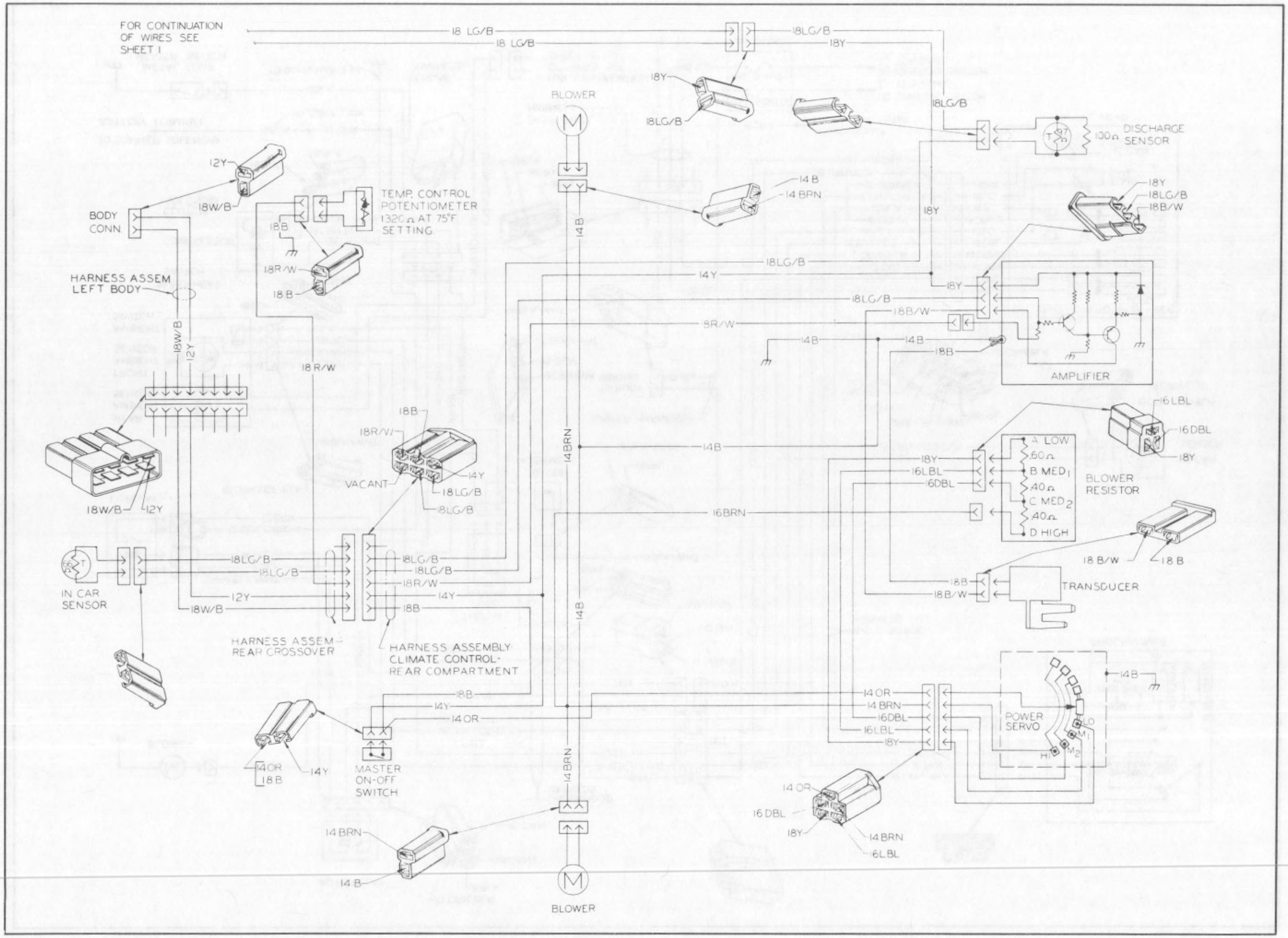


Fig. 1.95 Rear A/C Circuit Diagram

SERVICE INFORMATION

FLEETWOOD SEVENTY-FIVE REAR AIR CONDITIONER

54. Adjustments

a. Temperature Door Link

1. Loosen temperature door adjusting link screw.
2. Apply vacuum to power servo vacuum power unit.
3. Tighten temperature door adjusting link until head of screw contacts link then continue to tighten just enough to take play out of link.

b. Temperature Dial

(NOTE: If system is working properly, perform temperature dial test as described in Notes 56a, step 6, 56a, step 7, or 56c.)

Although the temperature dial may be operating correctly, it may be necessary to change the temperature dial setting for customer satisfaction. If an owner indicates a particular temperature dial setting where he is most comfortable, set temperature dial to that setting and proceed as follows:

1. Insert Temperature Dial Adjuster, J-21530, between temperature dial and casting. (Refer to Fig. 1-86.)
2. Turn dial to proper setting as determined by test procedure used.

55. Performance Test

To determine the efficiency of the Fleetwood Seventy-Five Air Conditioning system, run a performance test as outlined below:

1. Place transmission in PARK and start engine.
2. Check operation of controls by rotating temperature dials from stop to stop.
3. Turn off engine.
4. Purge high and low pressure lines on Charging Station J-23500.
5. Connect Charging Station high pressure line to fitting on high pressure vapor line, and low pressure line to evaporator gage fitting on suction throttling valve.
6. Disconnect vacuum hoses from both power servo vacuum power units and plug hoses.
7. Close hood as far as possible without pinching lines.
8. Place auxiliary fan (approximately 24 inch dia. blades) 24 inches from front bumper and direct air stream to center of radiator grille.
9. Place thermometer in air stream between auxiliary fan and radiator grille. Thermometer bulb must not contact any metal.
10. Place another thermometer in right front air conditioning outlet grille. Thermometer bulb must not contact any metal.
11. Open all doors and windows.
12. Use Humidicator, J-6076, to obtain simultaneous temperature and relative humidity readings of air entering air intake grille as follows:

a. Shake thermometer down to settle red and blue columns in bottom of tubes.

b. Throughly moisten wick on blue thermometer with water.

c. Place humidicator on right hand side of cowl air intake grille so that entering air passes over bulbs of thermometer.

13. Place thermometer in right rear roof outlet and open deflector doors.
14. Place another thermometer on center of package shelf over return air intake.
15. Turn on auxiliary fan.
16. With transmission in PARK, start engine and operate at 2,000 rpm.
17. After five minutes, record:

a. Humidicator red and blue bulb readings. (Red bulb reading is temperature of air entering air intake grille.)

b. Temperature of air being discharged through right front air conditioning outlet.

c. Temperature of air entering grille.

d. Head pressure.

e. Front evaporator pressure.

f. Temperature of air being discharged from right rear outlet.

g. Temperature of air returning to rear evaporator assembly.

18. Turn off engine and auxiliary fan.
19. To determine relative humidity of air entering air intake grille, position inner scale of humidicator so that blue (wet bulb) temperature is opposite red (dry bulb) temperature. Relative humidity is indicated by humidity arrow. Record relative humidity.
20. Refer to Chart C, Fig. 1-96 to determine if outlet air temperatures are normal. If outlet temperatures are the same or below reading on chart, operation is normal.
21. Refer to Chart D, Fig. 1-96 to determine if head pressure is normal. If head pressure is within 30 pounds below reading on chart, operation is normal.
22. Disconnect Charging Station.
23. Install vacuum hose on power servo vacuum power units after unplugging.

56. Connecting Automatic Climate Control Tester

The Automatic Climate Control Tester, J-21512, and the Automatic Temperature Control Tester, J-22368-01,

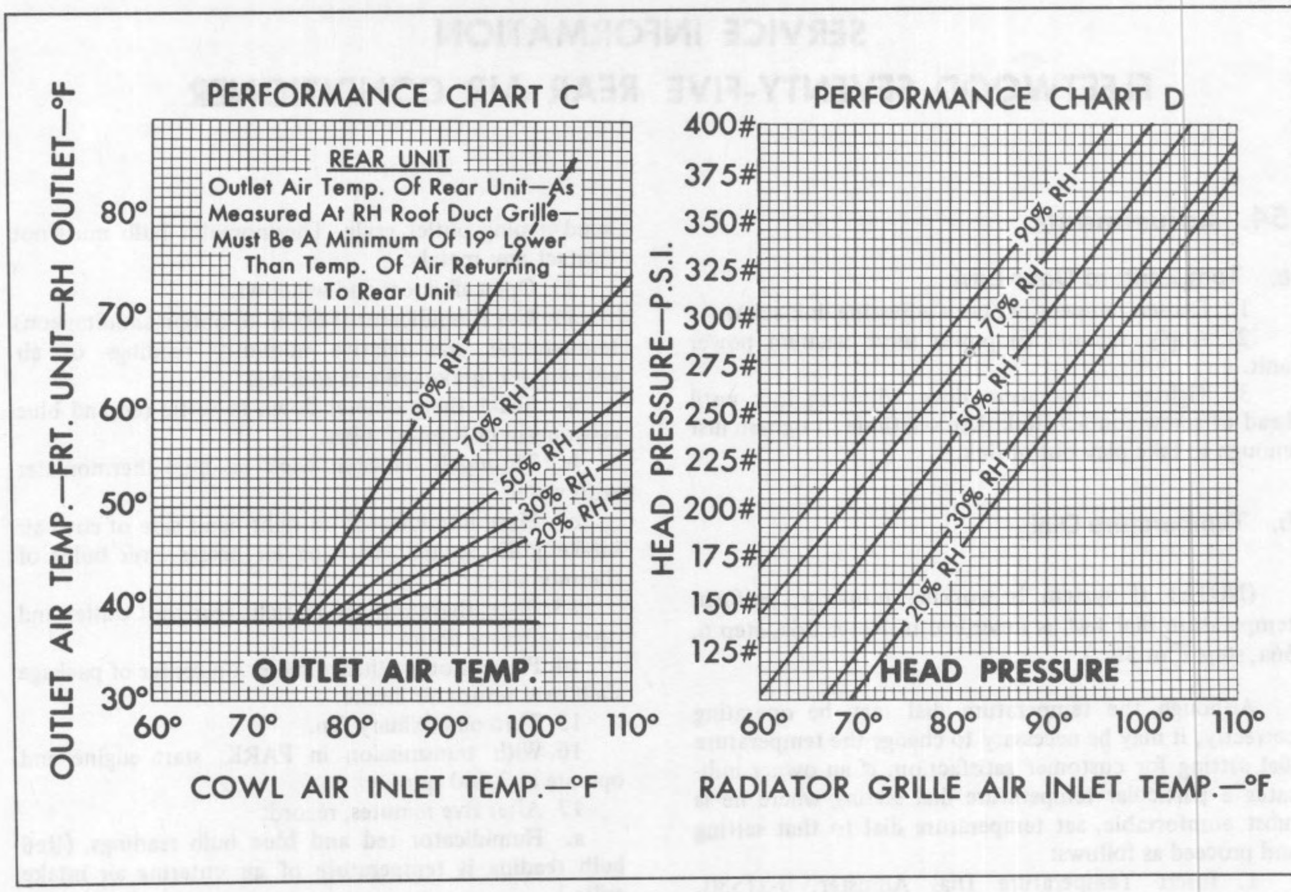


Fig. 1-96 A/C Performance Chart

are used to isolate an electrical malfunction in the Automatic Climate Control system by serving as a substitute for components of the system. Due to differences between the testers, two procedures are given in this note. Follow the test procedure that applies to the tester to be used.

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system, when the system turns ON, but operates only in maximum heat or maximum air conditioner at high blower speed. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 6. If system still performs incorrectly, proceed as follows:

(NOTE: For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.)

a. Automatic Climate Control Tester, J-21412

1. Preliminary Test

a. Place transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in stops b and c, proceed to step 2.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 5.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

2. Sensor String Test

a. Turn engine off if still operating, and connect Automatic Climate Control Tester, J-21512.

b. Set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position.

e. Place Sensor switch to A/C position, System and tester meter should go to full air conditioning.

f. Place Sensor switch in HTR position. System and tester meter should go to full heater.

g. If system did not perform correctly in steps e and f, proceed to step 3.

h. If system performed correctly, disconnect Automatic Climate Control Tester and reconnect car wiring harness. Visually inspect in-car sensor, replace if apparently defective, and check operation of system.

i. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

j. If an ohmmeter is available, measure resistance value of ambient sensor, and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-3. Replace any defective sensor located. If no defective sensor is found, check car wiring.

k. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

3. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place Amplifier switch on Automatic Climate Tester, J-21212, in AMPLIFIER position.

b. Turn Amplifier Control counterclockwise to stop. System and tester meter should go to full air conditioning.

c. Turn Amplifier Control clockwise to stop. System and tester meter should go to full heater.

(NOTE: If tester meter does not vary with variation in Amplifier Control, transducer or electrical circuit to transducer is defective.)

d. If steps b and c do not result in correct system operation, proceed to step 4.

e. If system operated properly in steps b and c, disconnect Automatic Climate Control Tester and reconnect car wiring harness to amplifier.

f. Disconnect red wire from temperature dial rheostat terminal on amplifier. With wire open, system should go to full air conditioning.

g. Ground red wire. System should go to full heat.

h. If system performed properly in steps f and g replace temperature dial rheostat.

i. If system failed to perform properly in steps f and g, replace amplifier circuit board.

j. If system fails to work properly after replacing amplifier circuit board, check car wiring.

4. Regulated Vacuum Test

(NOTE: Automatic Climate Control Tester, J-21512, should still be plugged in and engine should be running.)

a. Connect a vacuum gage to transducer vacuum input hose. Gage should read above 14 inch Hg. If not, locate and correct vacuum failure.

b. Reconnect vacuum input hose and connect vacuum gage to transducer output fitting, using a length of vacuum hose.

c. Make certain that temperature dial is at 71° setting.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position. Turn sensor switch to MID position and rotate temperature dial until tester meter needle reads on set line. Vacuum gage should read between 3.5 inch Hg. and 7.2 inch Hg. If not, replace transducer.

e. Rotate temperature dial to 65° setting. Vacuum gage should read 1.5 inch Hg. or less. If vacuum reading is lower, turn Sensor switch to A/C position, gage should now read 1.5 inch Hg. or less. If not, replace transducer.

f. Repeat step d.

g. Rotate temperature dial to 85° setting, vacuum gage should read 10 inch Hg. or more. If vacuum reading is lower, turn Sensor switch to HTR position, gage should now read 10 inch Hg. or more. If not, replace transducer. Check car wiring.

h. Rotate temperature dial to 71° setting and place Amplifier switch in AMPLIFIER position. Rotate tester Amplifier control from stop to stop. Output of transducer should vary between 1.5 inch Hg. or less, to 10 inch Hg. or more within 10 seconds. If not, replace transducer.

5. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 71° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

(NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.)

d. Rotate temperature dial back to 71° except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Fig. 1-92 determine what valves, hoses and vacuum power units are involved to locate leak.

6. Temperature Dial Test with Automatic Climate Control Tester, J-21512.

(NOTE: This test can be made only when the system is operating properly.)

a. Place Amplifier switch in SENSOR position.

b. Place Sensor switch in MID position.

c. Adjust temperature dial until tester meter reads on SET line. Temperature dial should read 71°.

d. If temperature dial does not read 71°, adjust dial as described in Note 53.

7. Shut off engine and remove Automatic Climate Control Tester from system and connect car wiring harness to amplifier connector.

8. Intermittent Conditions

a. Connect the positive lead of an accurate volt-

meter to the transducer wire at the transducer connector. Ground the negative lead to the car body.

b. Allow system to operate and stabilize.

c. Tap the sensors, temperature dial and amplifier. A severe rap is necessary. Jiggle wires to the various units.

d. Watch the voltmeter for any sharp variation in the meter reading. Note the operation of the system.

e. If a variation occurs when a unit is tapped, check that unit for loose connections. Repair connections as necessary.

b. Automatic Temperature Control Tester, J-22368-01

1. Preliminary Test

a. Place Transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in steps b and c, proceed to step 3.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 6.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

h. If system failed to turn on, proceed to step 2.

2. Source Test

a. Turn off engine if still operating and connect Automatic Temperature Control Tester, J-22368-01.

b. Turn system ON and set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place rocker switch on Automatic Temperature Control Tester, J-22368-01 in MANUAL position.

e. Turn voltage knob to SOURCE position.

f. Set manual control knob to 150 position.

g. Tester meter should read battery voltage.

h. If meter does not read battery voltage, check the power supply wires for shorts, grounds or opens. Check for blown fuse. The tester may be used for checking the wiring by turning the voltage knob to PROBE position and using the red probe.

i. If meter read battery voltage in step g, proceed to step 3.

3. Sensor String Test (Opens)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to SENSOR position.

c. Set manual control knob to 150 position.

d. Tester meter should read battery voltage.

e. If meter read battery voltage in step d, proceed to step 4.

f. If meter did not read battery voltage in step d, visually inspect in-car sensor, replace if apparently defective, and check operation of system.

g. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

h. If an ohmmeter is available, measure resistance value of ambient sensor, and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-3. Replace any defective sensor located. If no defective sensor is found, check car wiring.

i. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

4. Amplifier Test

(NOTE: Sensor string must be tested before testing amplifier.)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Turn manual control to MAX. HEAT position.

d. Meter should read from 0 to 4 volts.

e. Turn manual control to MAX. COLD position.

f. Meter should read 8 volts minimum.

g. If steps c through f do not result in correct readings, proceed to step i.

h. If proper readings were achieved in steps c through f, proceed to step 5.

i. Disconnect red wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning. Meter should read 8 volts minimum.

j. Ground red wire. System should go to full heat, meter should read 0-4 volts.

k. If system performed properly in steps i and j, replace temperature dial rheostat.

l. If system failed to perform properly in steps i and j, replace amplifier circuit board.

m. If system fails to work properly after replacing amplifier circuit board, check car wiring.

5. Transducer Test

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to TRANSDUCER position.

c. Turn manual control to MAX. COLD position.

d. Tester meter should read 8 volts minimum and vacuum gage should read 0-3 inches vacuum. Maximum blower should be achieved.

e. Turn manual control to MAX. HEAT position.

f. Tester meter should read 0-4 volts and vacuum gage should read 9 inches minimum vacuum. Maximum blower should be achieved.

g. If proper readings are not obtained in steps c through f, check wiring to transducer circuit for shorts, grounds or opens. Check for improperly grounded transducer. Replace transducer.

6. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 70° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

(NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.)

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Fig. 1-92 and Fig. 1-93 determine what valves, hoses and vacuum power units are involved to locate leak.

7. Temperature Dial Test with Automatic Temperature Control Tester, J-22368-01.

a. Place rocker switch in MANUAL position.

b. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Set manual control to 138 position.

d. Rotate temperature dial until tester meter indicates 6.5 volts.

e. Temperature dial should indicate 75°F.

f. If temperature dial does not indicate proper setting, adjust temperature dial as indicated in Note 53.

8. Operational Test

a. Both systems should be turned ON, the front system should be operating in AUTO. The temperature dials should be st at 75°.

b. Position rocker switch in AUTOMATIC position.

c. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

d. Set manual control to 150 position.

e. Allow five minutes for systems to stabilize with doors and windows closed.

f. Meter should read 5.5 - 7.5 volts.

g. If improper reading is obtained in step f, check for shorted sensor.

h. If proper reading is achieved in step f, tap sensors and amplifier.

i. If meter needle jumps when a unit is tapped, check that unit for weak connections that will cause an intermittent defect in system.

j. If proper reading is achieved in step f, with no movement of the needle in step i and all steps in part steps 1-7 have been completed, system is operating properly.

k. Shut off engine and remove Automatic Temperature Control Tester, J-22368-01 from system. Connect car wiring harness connector to amplifier connector and large vacuum hose to transducer. Install any trim items removed.

c. Temperature Dial Operational Test

(NOTE: This test is performed without the Automatic Temperature Control Tester, J-22368-01, or Automatic Climate Control Tester, J-21512. Although it is less efficient it allows for the tailoring of a system to meet the requirements of an individual owner.)

a. Using masking tape, suspend a thermometer from headliner so that bulb hangs at breath level over front passenger's seat.

b. Suspend a second thermometer at breath level midway between the rear roof outlets.

c. Position auxiliary fan (approximately 24 inch dia. blades) so that air stream is directed towards air intake grille.

d. Close all doors and windows.

e. Set both temperature dials to 75°.

f. With shift lever in PARK position, start engine and operate at 900 rpm.

g. Making certain that all air conditioner outlets are open, adjust as follows:

1. Front end outlets so that air is directed toward doors.
2. Front center outlet so air is directed toward top of front seat.
3. Rear roof outlet diverter doors should be opened.

(NOTE: Outlet air must not be directed toward thermometers.)

h. Allow systems to operate for 25 minutes for stabilization, then record reading from suspended thermometers.

i. If thermometers vary from 75° setting, adjust temperature dials to coincide with nearest thermometer reading, as indicated in Note 53.

57. Automatic Climate Control Panel

a. Removal

1. Remove rear seat cushion by lifting forward edge and pulling forward.
2. Remove rear seat back by removing two screws along lower edge and lifting assembly off mounting hooks.
3. Remove six screws securing right armrest to trim panel and remove armrest.
4. Remove trim pad from right side panel for access to back of panel.
5. Remove radio controls.
6. Remove electrical connectors from temperature dial and master "ON-OFF" switch.
7. Remove two screws securing control panel to trim pad and remove control panel.

b. Installation

1. Position control panel to trim pad and secure with two screws.
2. Connect electrical connectors at master "ON-OFF" switch and temperature dial.
3. Install radio controls.
4. Reposition trim pad and install in position on quarter panel.

5. Position armrest against quarter panel and secure with six screws.

6. Install rear seat back on mounting hooks and secure with two screws.

7. Install rear seat cushion.

58. Air Conditioner Control Panel Disassembly and Assembly

a. Temperature Dial Rheostat Removal

1. Remove control panel as described in Note 57a.
2. Disconnect electrical connector inside arm rest.
3. Remove two screws securing rheostat to control panel and remove rheostat.

b. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and secure with two screws.
2. Connect electrical connector.
3. Install control panel as described in Note 57b.
4. Adjust temperature dial as described in Note 52.

c. Control Switch Removal

1. Remove control panel as described in Note 57a.
2. Disconnect black and yellow hoses from control switch.
3. Remove two screws and remove switch.

d. Control Switch Installation

1. Position switch to control panel and secure with two screws.
2. Connect black and yellow hoses to ports as indicated by color coding dots on switch assembly.
3. Install control panel as described in Note 57b.

59. Amplifier

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from amplifier terminals.
3. Disconnect red wire at single connector.
4. Remove spring clip securing multiple connector to mounting plate.
5. Remove screw securing amplifier circuit board to mounting plate.

b. Installation

1. Position amplifier circuit board to mounting plate and install screw securing circuit board to mounting plate.
2. Install spring clip securing multiple connector to mounting plate.
3. Connect red wire at single connector.
4. Connect multiple connector to amplifier terminals.
5. Install trim panel inside luggage compartment.

60. In-Car Sensor

a. Removal

1. Snap protective grille off in-car sensor on package shelf inside car.
2. Remove two screws securing sensor to package shelf.
3. Disconnect in-car sensor from electrical connector.
4. Carefully remove in-car sensor.

b. Installation

1. Connect in-car sensor to electrical connector.
2. Position in-car sensor on package shelf.
3. Secure in-car sensor to package shelf with two screws.
4. Snap protective grille over in-car sensor on package shelf.

61 Duct Sensor

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect electrical connector from sensor terminals.
3. Remove two screws securing sensor to right mode door assembly and remove sensor.

b. Installation

1. Position sensor to right mode door assembly and secure with two screws.
2. Connect electrical connector to sensor terminals.
3. Install trim panel inside luggage compartment.

62. Water Control Valve

(NOTE: The water control valve and thermal vacuum valve are serviced as an assembly.)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Pinch off valve inlet and outlet water hoses, Fig. 1-97.
3. Position shallow pan under water control valve to catch any coolant that may spill.
4. Remove clamps securing hoses to valve, and remove water hoses.
5. Remove vacuum hoses from thermal vacuum valve, and remove vacuum hose from water control valve vacuum power unit.
6. Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.
2. Install water hoses on valve inlet and outlet fittings and install clamps on hoses.
3. Remove clamps pinching off hoses.
4. Install vacuum hoses on thermal vacuum valve.

(NOTE: Yellow striped hose connects to vacuum nipple closest to water outlet fitting.)

5. Connect red striped vacuum hose to water control valve vacuum power unit.
6. Install trim panel inside luggage compartment.
7. Replace any coolant lost.

63. Blower Resistor

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from blower resistor.
3. Remove single connector from blower resistor.
4. Remove two screws securing blower resistor to bottom of case assembly.
5. Remove blower resistor from bottom of case assembly.

b. Installation

1. Position blower resistor into bottom of case assembly.
2. Secure resistor to case assembly with two screws.
3. Install single connector on blower resistor.
4. Install multiple connector on blower resistor.
5. Install trim panel inside luggage compartment.

64. Blower Motor Assemblies

This procedure applies to both right and left blower motors.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect double connector at motor to be removed. Connector is located in front of motor, Fig. 1-97.
3. Pull back rubber material from screw heads and remove five screws securing blower motor to blower housing.
4. Remove blower and fan assembly.

b. Installation

1. Position blower motor and fan assembly in blower housing and secure with five screws, and replace rubber insulating material.
2. Connector double connector.
3. Install trim panel inside luggage compartment.

65. Master Switch

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from master switch.
3. Disconnect electrical connector from master switch.
4. Remove screw securing master switch mounting bracket to case and remove master switch and mounting bracket.
5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.
2. Position master switch mounting bracket to case and install screw securing mounting bracket to case.
3. Connect electrical connector to master switch.
4. Install vacuum hoses to master switch.
5. Install trim panel inside luggage compartment.

66. Power Servo

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect multiple electrical connector from power servo, Fig. 1-97.
3. Disconnect multiple vacuum connector from servo valve.
4. Disconnect vacuum hose from power servo vacuum power unit.
5. Disconnect temperature door link at temperature door arm.
6. Remove two screws securing power servo to case.
7. Remove power servo.

b. Installation

1. Position power servo into opening in case and secure with two screws.
2. Connect vacuum hose to power servo vacuum power unit.
3. Connect multiple vacuum connector to servo valve.
4. Connect multiple electrical connector.
5. Connect and adjust temperature door link – Note 54a.
6. Replace trim panel inside luggage compartment.

67. Power Servo Vacuum Valve

a. Removal

1. Disconnect multiple hose connector.
2. Remove spring clip and one screw securing vacuum valve to power servo.
3. Remove vacuum valve.

b. Installation

1. Position vacuum valve on power servo and secure with one screw and spring clip.
2. Connect multiple hose connector.

68. Mode Door Assemblies

This procedure applies to both right and left mode door assemblies.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove duct sensor electrical connector from right mode door assembly only.
3. Remove vacuum hose from mode door vacuum diaphragm.
4. Remove three nuts securing de-fogger duct to outlet grille on package shelf.
5. Loosen clamps securing mode door assembly to blower assembly, heater discharge and air conditioner discharge hoses.

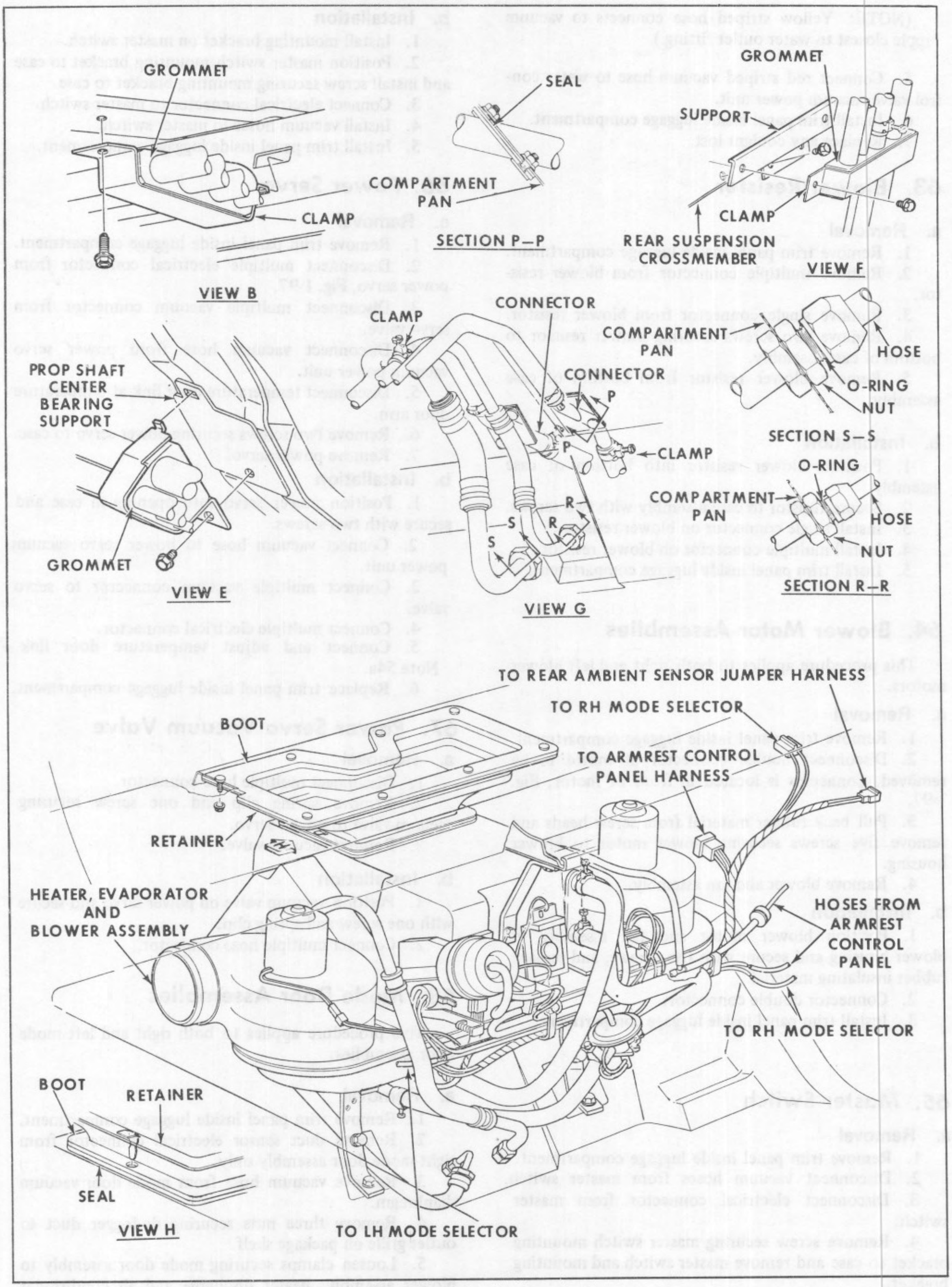


Fig. 1-97 Rear Heater, Evaporator and Blower Assembly

6. Slide discharge hoses off of mode door assembly and lift assembly off of blower outlets.

b. Installation

1. Install mode door vacuum hose on diaphragm.
2. Position mode door assembly on blower outlet.
3. Position heater discharge and air conditioner discharge hoses on mode door assembly.
4. Secure mode door assembly on blower assembly by tightening clamp.
5. Secure heater discharge and air conditioner discharge hoses onto mode door assembly by tightening clamps.
6. Position de-fogger ducts to outlet grille on package shelf, retaining with three nuts.
7. Install duct sensor electrical connector into right mode door assembly only.
8. Install trim panel inside luggage compartment.

69. Transducer

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from fittings on transducer.
3. Disconnect transducer electrical connector.
4. Remove two screws securing transducer mounting bracket to power servo and remove transducer.

b. Installation

1. Position transducer to power servo and secure with two screws.
2. Connect transducer electrical connector.
3. Connect vacuum hoses to fittings on transducer.

(NOTE: Vacuum hose with smallest I.D. goes on top fitting of transducer.)

4. Replace trim panel inside luggage compartment.

70. Blower Evaporator Assembly

a. Removal

1. Remove trim panel inside luggage compartment.
2. Purge system as described in Note 49.
3. Drain engine cooling system.
4. Raise rear of car and remove clamp securing evaporator drain and remove drain.
5. Disconnect right and left mode door assemblies from blower motors and disconnect tan vacuum hoses.
6. Disconnect ambient air hoses from blower evaporator assembly.
7. Disconnect ambient and duct sensor leads.
8. Disconnect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum supply hose at connector where they enter luggage compartment below blower evaporator assembly.
9. Disconnect six way electrical connector from body wiring at right side of car.
10. Disconnect yellow and black vacuum hoses at right side of car.
11. Unsnap return air boot from blower evaporator assembly.
12. Remove screw securing bracket to package shelf.
13. Remove four screws securing brackets to floor pan.
14. Lift blower evaporator assembly out of luggage compartment.

b. Installation

1. Position blower evaporator assembly in luggage compartment.
2. Connect right and left mode door assemblies to blower evaporator outlets.
3. Connect tan vacuum hoses.
4. Connect return air boot to blower evaporator case.
5. Connect yellow and black vacuum hoses at right side.
6. Connect six-way electrical connector at right side.
7. Connect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum hose at connectors under blower evaporator assembly. Refer to Fig. 1-97. Recover low pressure hose with insulation.
8. Connect ambient and duct sensor leads.
9. Connect ambient air hoses to blower evaporator.
10. Secure lower brackets to floor pan with four cap screws.
11. Secure upper bracket to package shelf with screw.
12. Raise rear of car and install evaporator drain assembly.
13. Fill engine cooling system.
14. Evacuate system as described in Note 49b.
15. Charge system as described in Note 49d.
16. Replace trim panel inside luggage compartment.

71. POA Suction Throttling Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove screw securing suction throttling valve clamp to case assembly.
3. Disconnect equalizer line.
4. Disconnect low pressure line form suction throttling valve.
5. Disconnect suction throttling valve from evaporator outlet pipe.

b. Installation

1. Connect suction throttling valve to evaporator outlet pipe.
2. Connect low pressure line to suction throttling valve, and cover with insulation.
3. Connect equalizer line to suction throttling valve.
4. Secure suction throttling valve to case assembly with clip and one screw.
5. Install blower evaporator assembly as described in Note 70b.

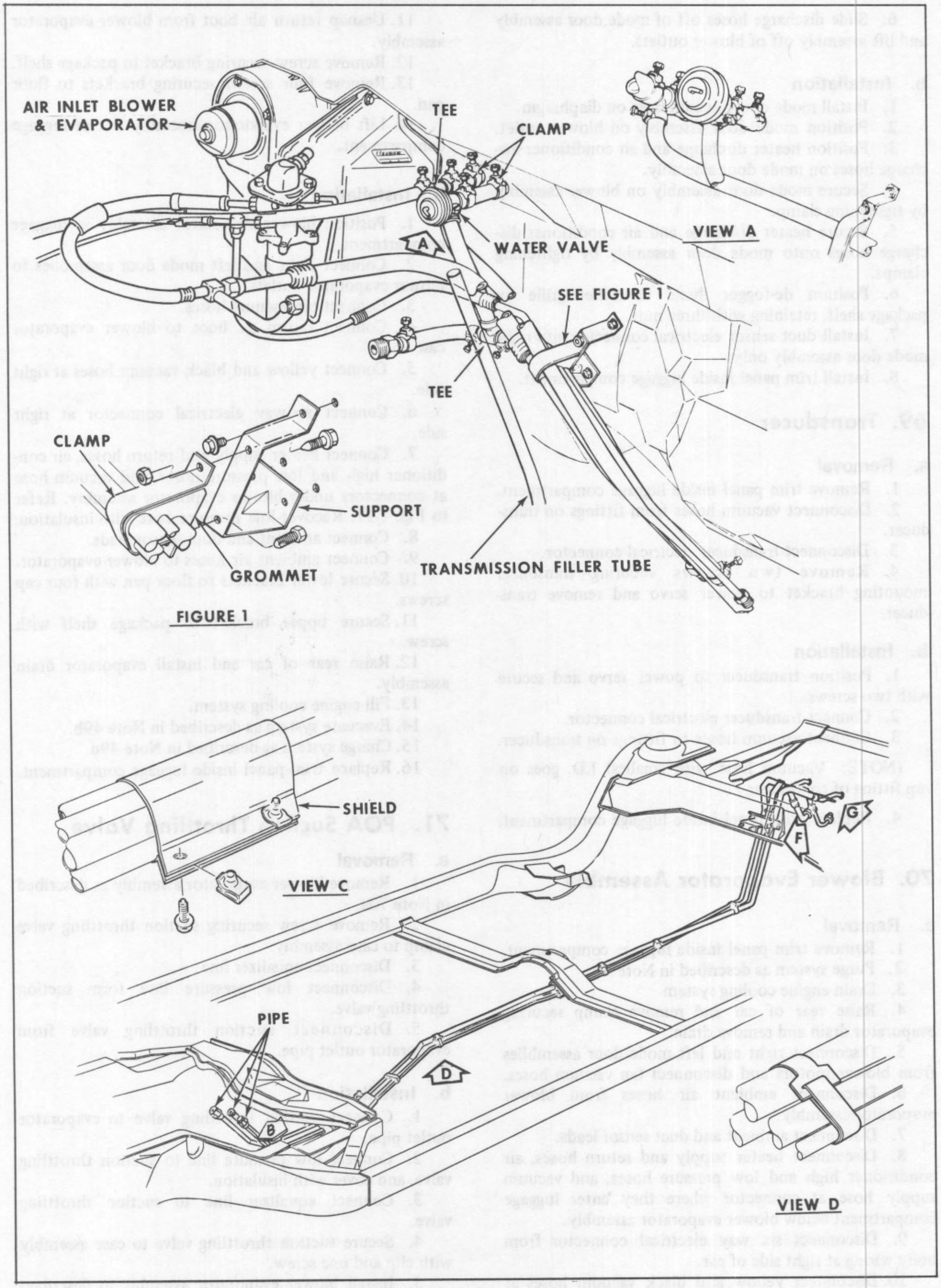


Fig. 1-98 Refrigerant and Coolant Lines

72. Evaporator Core

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove 29 screws and 4 nuts holding evaporator case together and remove bottom of case.
3. Remove screw and clamp securing high pressure line to bottom of case assembly.
4. Disconnect suction throttling valve from evaporator outlet pipe.
5. Disconnect equalizer line from suction throttling valve.
6. Remove ambient air inlet fittings from case.
7. Remove four screws on top of case securing evaporator core to case and remove evaporator core from case.
8. Remove expansion valve from evaporator core as described in Note 73a.

b. Installation

1. Install expansion valve to evaporator core as described in Note 73b.
2. Position evaporator core in case assembly and secure with four screws.
3. Install ambient air inlet fittings on case.
4. Connect suction throttling valve to evaporator outlet pipe.
5. Connect equalizer line to suction throttling valve.
6. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
7. Secure high pressure line to bottom of case with clamp and screw.
8. Install blower evaporator assembly as described in Note 70b.

73. Expansion Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove evaporator core assembly as described in Note 72a.
3. Remove power element bulb from evaporator outlet pipe.
4. Disconnect equalizer line from POA suction throttling valve.
5. Disconnect expansion valve from evaporator inlet.

b. Installation

1. Connect expansion valve to evaporator inlet.
2. Connect equalizer line to suction throttling valve.
3. Position power element bulb on evaporator outlet and secure.
4. Replace evaporator core assembly as described in Note 72b.
5. Replace blower evaporator assembly as described in Note 70b.

74. Heater Core

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove inlet and outlet hoses from heater inlet and outlet pipes.
3. Remove 29 screws and 4 nuts securing evaporator case together.
4. Remove clamp and screw securing high pressure line to bottom of case.
5. Remove sealing grommet around heater inlet and outlet pipes.
6. Remove 6 screws securing temperature door baffle to case and remove baffle.
7. Remove 6 screws, 3 each side of case, securing heater core and baffle to case.
8. Lift heater core and baffle from case.
9. Remove 4 screws securing baffle to heater core and remove baffle.
10. Remove retainers from heater core.

b. Installation

1. Position retainers to heater core and secure baffle to retainers with 4 screws.
2. Position heater core in case and secure with 6 screws, 3 each side.
3. Install temperature door baffle.
4. Seal hole around heater inlet and outlet pipes with sealing grommet.
5. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
6. Secure high pressure line to bottom of case with clamp and screw.
7. Install inlet and outlet hoses to heater core pipes.
8. Install blower evaporator assembly as described in Note 70b.

HEATER ONLY—ALL SERIES

75. Upper Level Ventilation Door Adjustment

(NOTE: There is no adjustment for the lower level ventilation door.)

Loosen screw that secures upper level ventilation door bowden cable clamp and position bowden cable so that door fully closes when knob is pushed all the way inward.

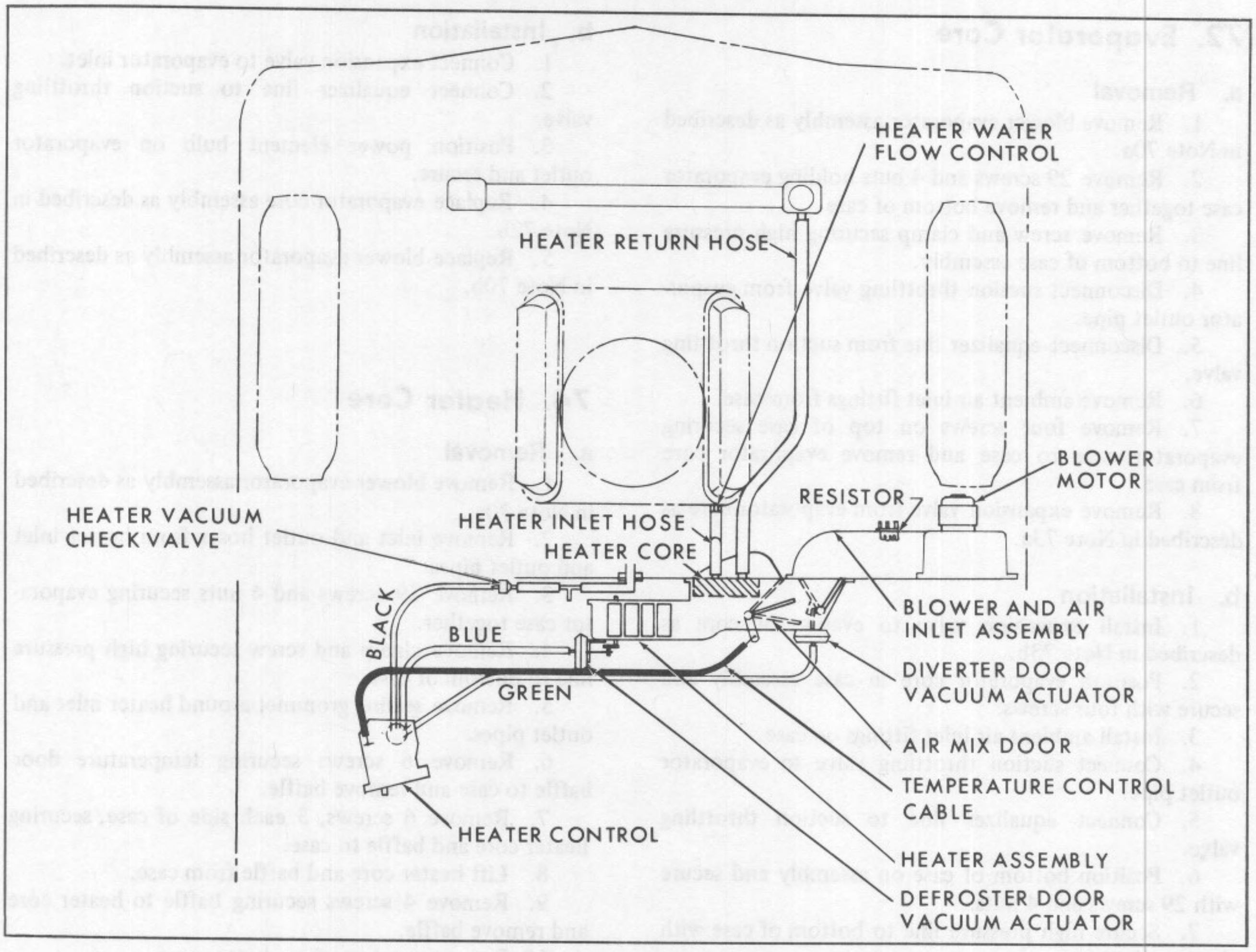


Fig. 1-99 Location Of Heater Components

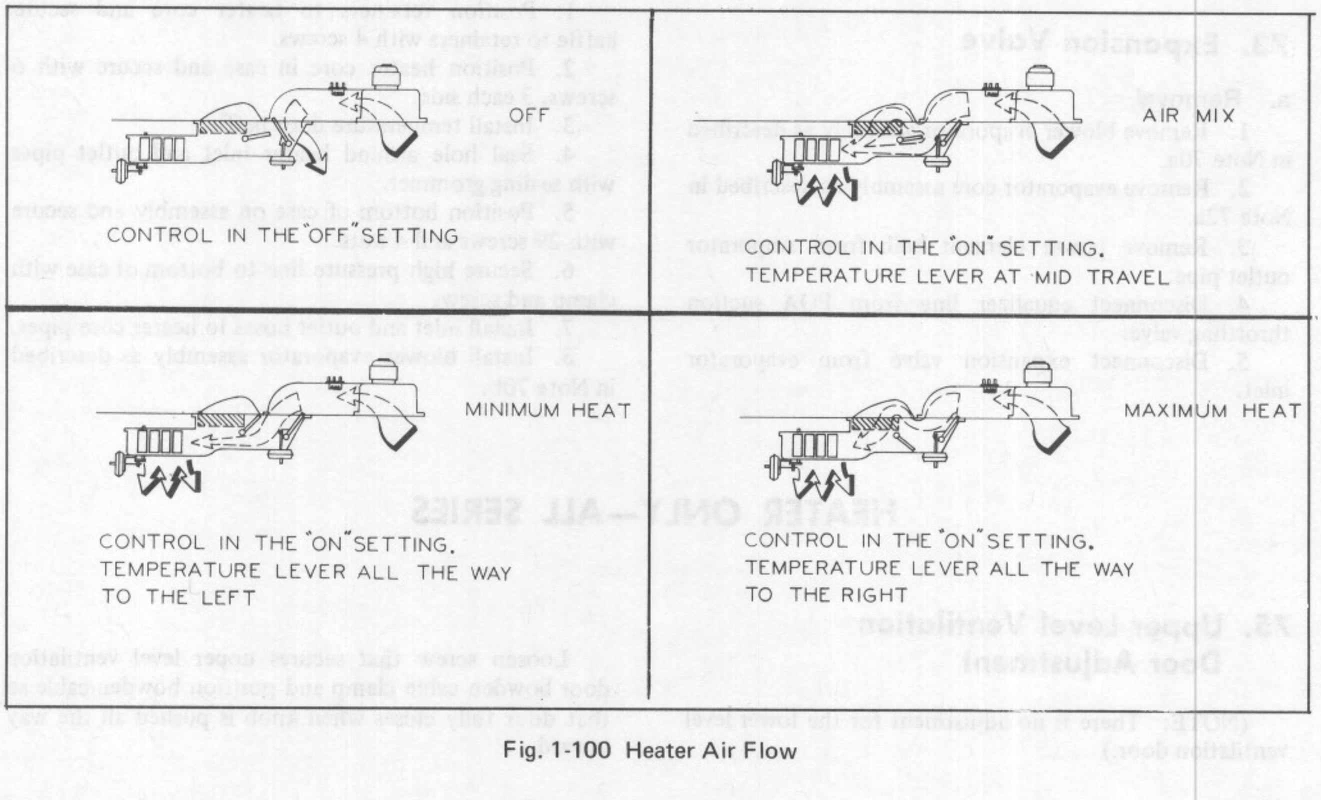


Fig. 1-100 Heater Air Flow

76. Heater Control Panel

The procedure for removing and installing the Heater Control Panel assembly is described in Section 12, Note

77. Blower Resistor

a. Removal

1. Disconnect electrical connector to blower resistor at heater blower assembly.

2. Remove two screws and resistor from heater-blower assembly.

b. Installation

1. Position blower resistor on heater blower assembly and secure with two screws.

2. Connect electrical connector at blower resistor.

78. Heater Blower Motor

a. Removal

1. Disconnect electrical connector at lead to motor, Fig. 1-102.

2. Remove five screws securing blower to case and remove blower.

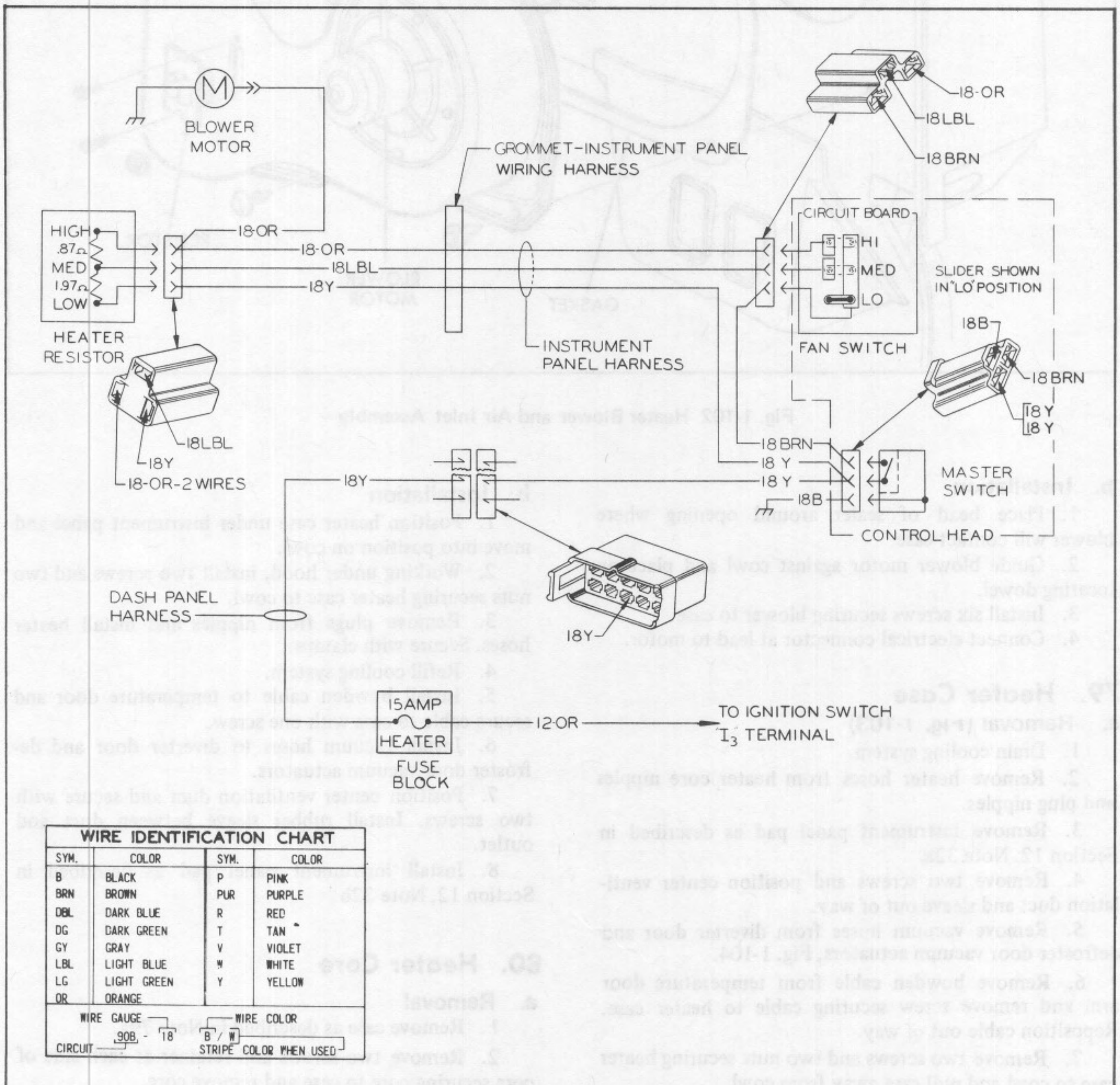


Fig. 1-101 Heater Electrical Circuit

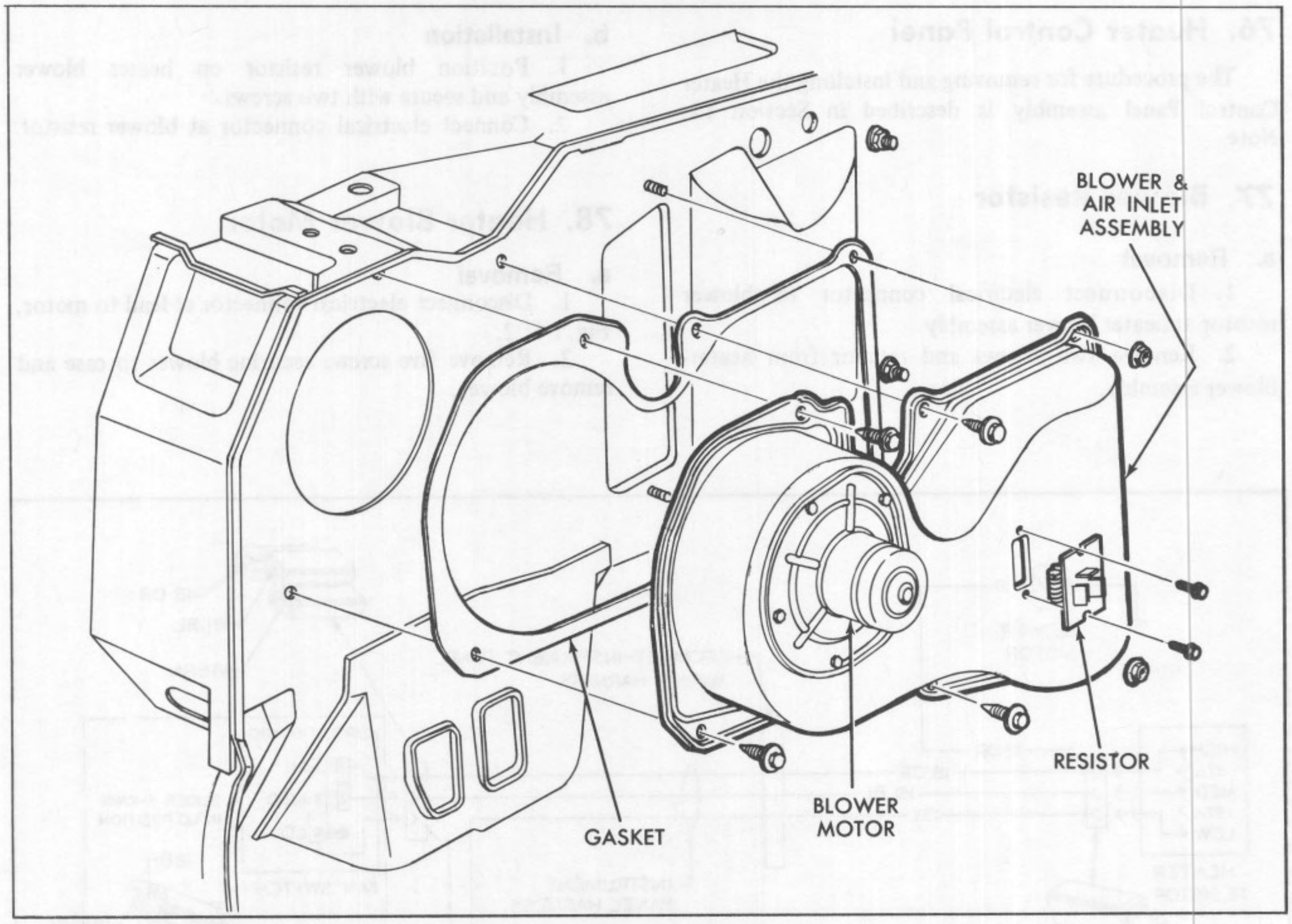


Fig. 1-102 Heater Blower and Air Inlet Assembly

b. Installation

1. Place bead of sealer around opening where blower will contact case.
2. Guide blower motor against cowl and place on locating dowel.
3. Install six screws securing blower to case.
4. Connect electrical connector at lead to motor.

79. Heater Case

a. Removal (Fig. 1-103)

1. Drain cooling system.
2. Remove heater hoses from heater core nipples and plug nipples.
3. Remove instrument panel pad as described in Section 12. Note 32a.
4. Remove two screws and position center ventilation duct and sleeve out of way.
5. Remove vacuum hoses from diverter door and defroster door vacuum actuators, Fig. 1-104.
6. Remove bowden cable from temperature door arm and remove screw securing cable to heater case. Reposition cable out of way.
7. Remove two screws and two nuts securing heater case to cowl and pull case away from cowl.
8. Remove heater case from position under in-instrument panel.

b. Installation

1. Position heater case under instrument panel and move into position on cowl.
2. Working under hood, install two screws and two nuts securing heater case to cowl.
3. Remove plugs from nipples and install heater hoses. Secure with clamps.
4. Refill cooling system.
5. Install bowden cable to temperature door and secure cable to case with one screw.
6. Install vacuum hoses to diverter door and defroster door vacuum actuators.
7. Position center ventilation duct and secure with two screws. Install rubber sleeve between duct and outlet.
8. Install instrument panel pad as described in Section 12, Note 32b.

80. Heater Core

a. Removal

1. Remove case as described in Note 79a.
2. Remove two screws and retainer at each side of core securing core to case and remove core.
3. Remove rubber grommet from heater core water nipples.

b. Installation

1. Install rubber grommet around water nipples and position core in heater case.

2. Position retainers at ends of core and secure with two screws.

3. Install heater case as described in Note 79b.

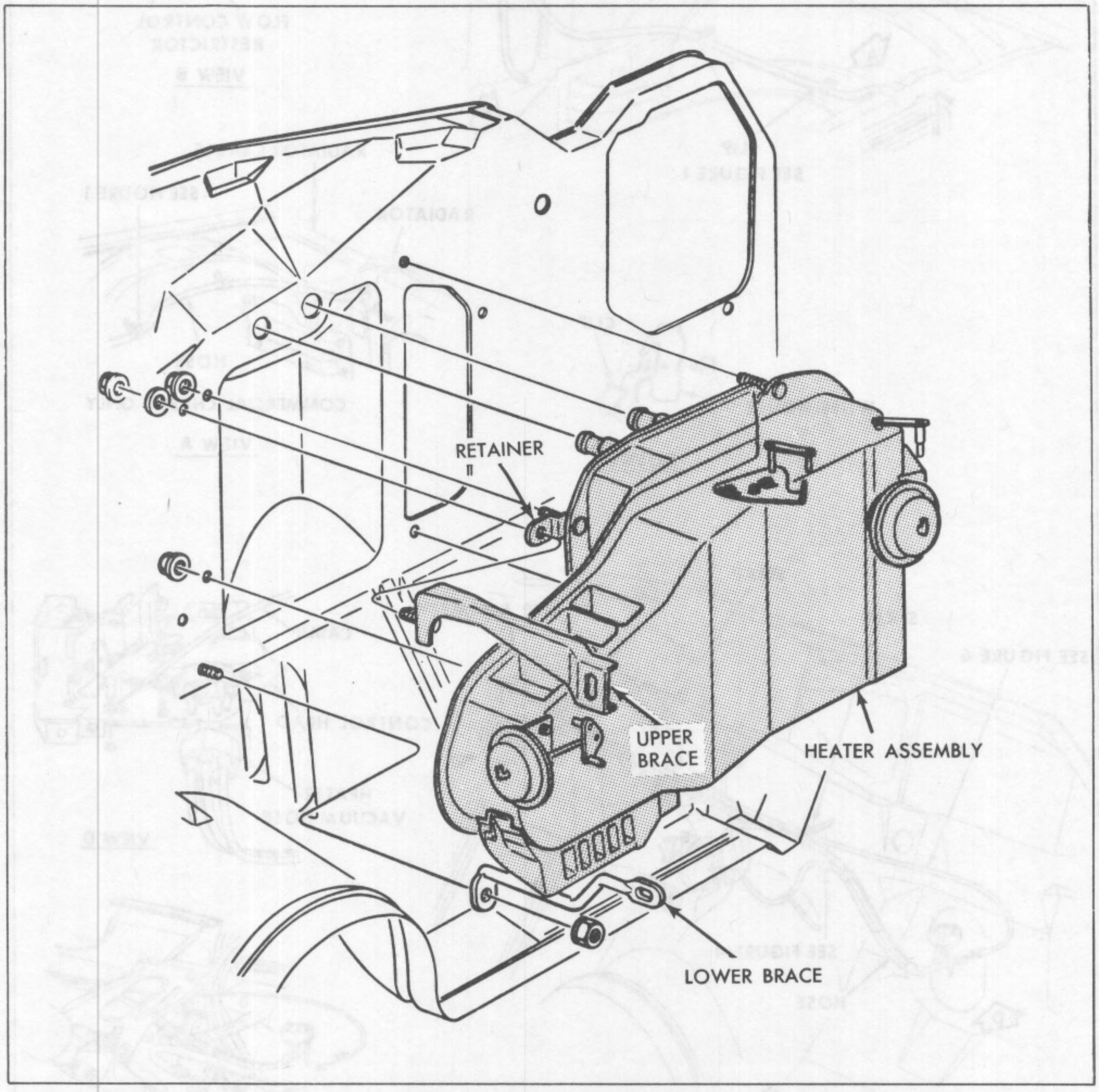


Fig. 1-103 Heater Assembly Installation

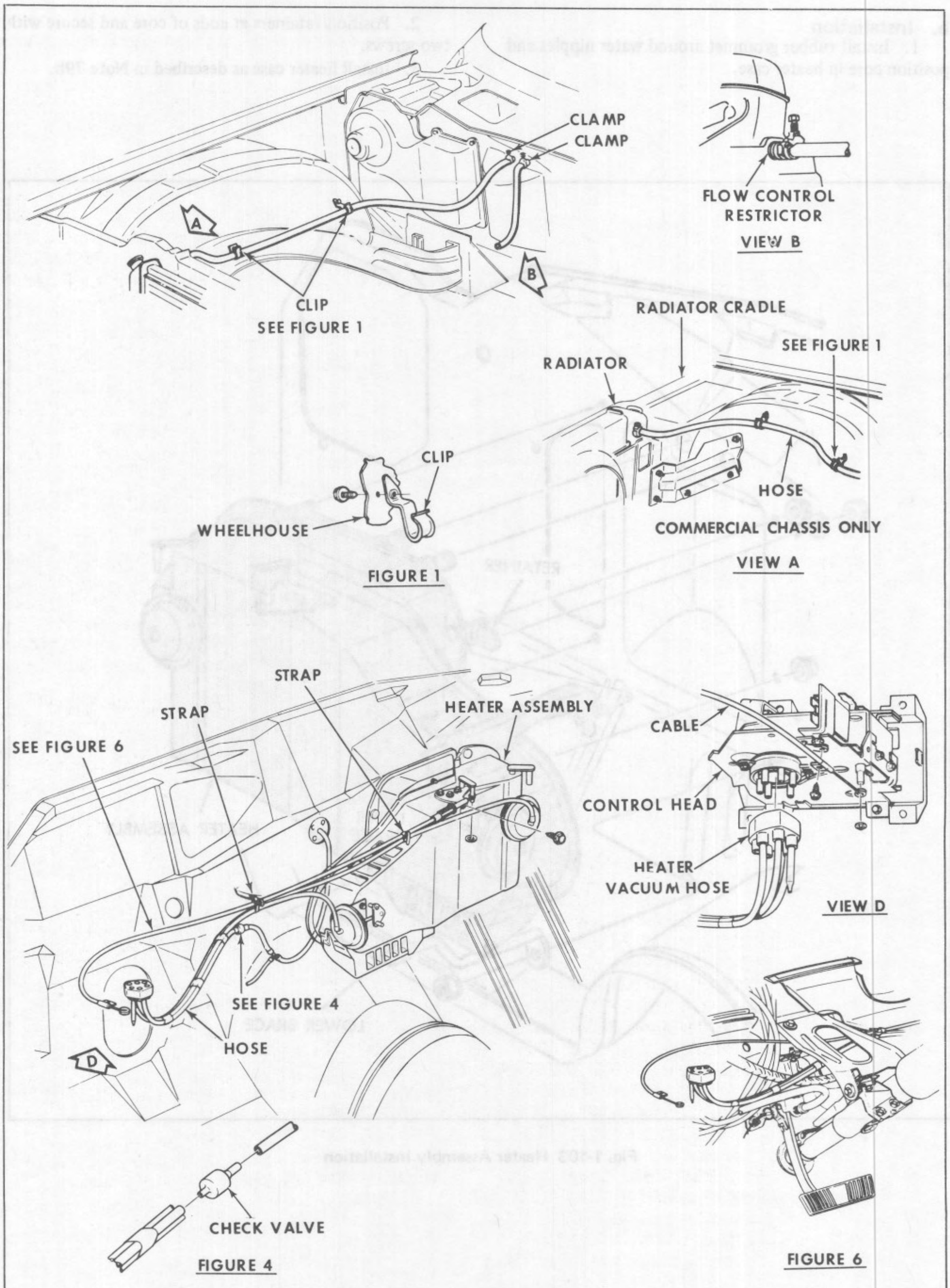


Fig. 1-104 Heater Vacuum Hoses and Cables

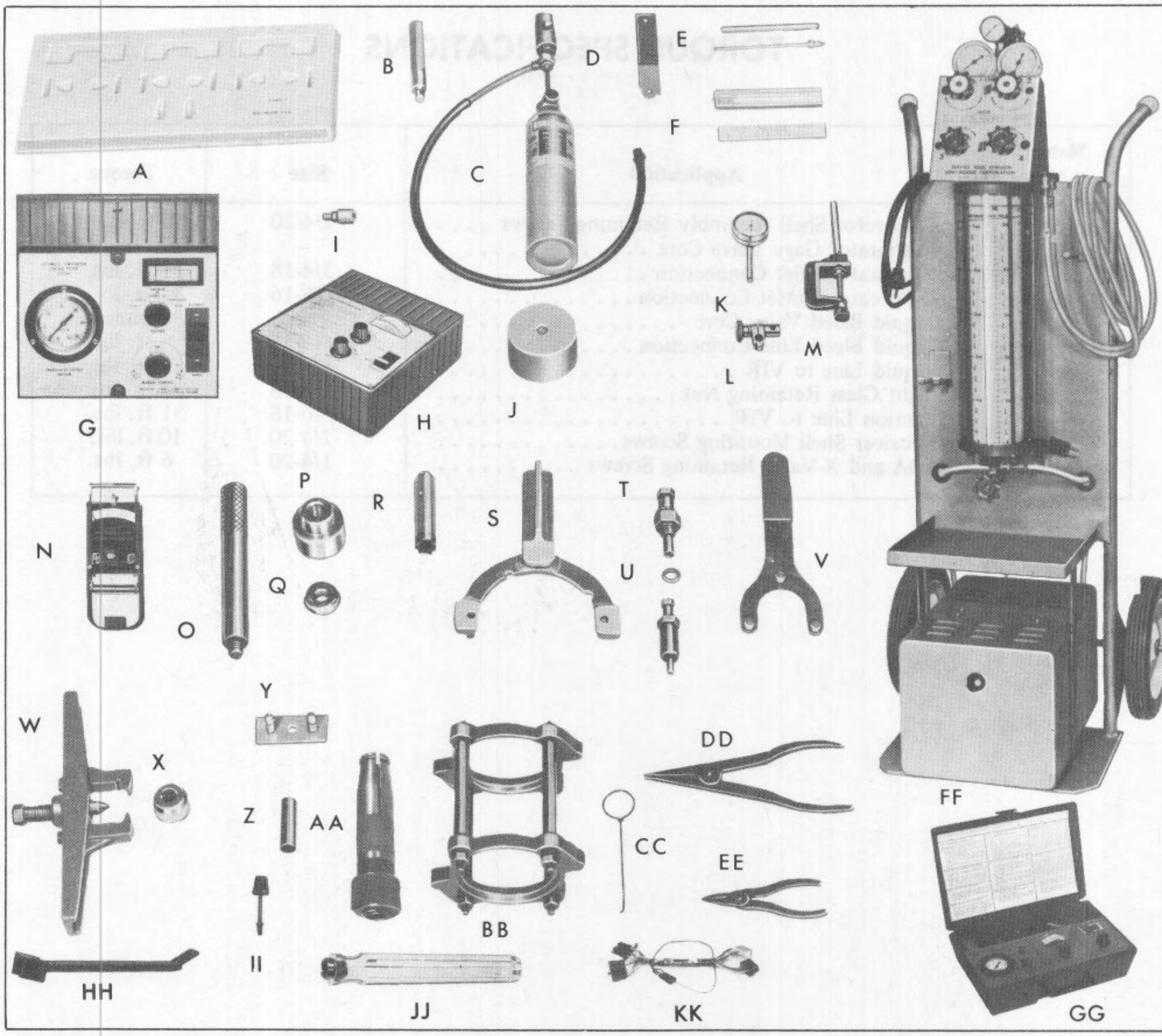


Fig. 1-105 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-9402	Parts Tray	T	J-9480	Clutch Plate and Hub Installer
B	J-9432	Needle Bearing Installer	U	J-9401	Clutch Plate and Hub Remover
C	J-6084	Leak Detector Torch	V	J-9403	Clutch Hub Holding Tool
D	J-21530	Temperature Dial Adjuster	W	J-8433	Pulley Puller
E	J-5421	Thermometer	X	J-9395	Puller Pilot
F	J-6076	Humidicator	Y	J-9625	Test Plate
G	J-21512	ATC Tester–75 Series	Z	J-9399	9/16" Thin Wall Socket
H	J-22368-01	ATC Tester–75 Series	AA	J-9393	Seal Seat Remover/Installer
I	J-5420	Gage Adapter (2 Required)	BB	J-9397	Compressor Fixture
J	J-9521	Internal Assembly Support	CC	J-5139	Oil Pick-Up Tube Remover
K	J-8001-3	Dial Indicator	DD	J-6435	Snap Ring Pliers (#26)
L	J-8001-2	Sleeve	EE	J-5403	Snap Ring Pliers (#21)
M	J-8001-1	Clamp	FF	J-23500	Charging Station
N	J-23600	Tension Gage	GG	J-23678	A/C Tester
O	J-8092	Universal Handle	HH	J-24182-1	Valve Capsule Remover
P	J-9398	Pulley Bearing Remover	II	J-24182-2	Valve Core Remover
Q	J-9481	Pulley and Bearing Installer	JJ	J-24182-3	Pick-Up Tube Installer
R	J-9392	Seal Remover and Installer	KK	J-24774	Harness Adapter
S	J-9396	Holding Fixture			

TORQUE SPECIFICATIONS

Material No.	Application	Size	Torque
300-M	Connector Shell Assembly Retaining Screws	1/4-20	10 ft. lbs.
Special	Evaporator Gage Valve Core	–	30 ounce in.
Aluminum	Evaporator Inlet Connection	3/4-18	18 ft. lbs.
Aluminum	Evaporator Outlet Connection	1-1/16-16	31 ft. lbs.
Special	Liquid Bleed Valve Core	–	30 ounce in.
Aluminum	Liquid Bleed Line Connection	7/16-24	6 ft. lbs.
Steel	Liquid Line to VIR	5/8-18	12 ft. lbs.
Steel	Sight Glass Retaining Nut	5/8-18	23 in. lbs.
Steel	Suction Line to VIR	1-1/16-18	31 ft. lbs.
300-M	Receiver Shell Mounting Screws	1/4-20	10 ft. lbs.
300-M	POA and X-Valve Retaining Screws	1/4-20	6 ft. lbs.

GENERAL DESCRIPTION

A swept torque-box perimeter type frame, Fig. 2-1, is used on "C" series Cadillac automobiles. The frame is of fully boxed construction throughout its entire length. It encircles the passenger compartment with heavy side members, permitting a low front floor with adequate seat height. This frame design also allows a small floor tunnel, and simplifies propeller shaft arrangement.

The forward portion of the front side rails (frame horns) are of heavy gage steel to provide a rigid mounting for the front bumper and its Energy Absorbing Devices and to withstand loads resulting from a 5 mph impact. The front cross member is recessed to allow space for bumper displacement during such impact. The front suspension tie struts are fastened directly to this cross member as is the center radiator cradle mount.

Two supports and a cross member are provided for the engine rear mount.

A center cross member is provided on the frames on Fleetwood Seventy-Fives and the Commercial Chassis to support the center bearing of the two-piece propeller shaft used on these models. This center cross member is located between the number 3 and number 4 body mounting locations.

The perimeter type frame used on the Commercial Chassis is similar to the passenger car frame; however, it has heavier construction features and incorporates a lower rear kick-up to meet the requirements of the flat floors used on commercial vehicles.

Eldorado

The Eldorado frame, Fig. 2-2, is similar to that of other styles in that it is a swept torque-box perimeter type of fully boxed construction. Front bumper mounting is identical to that of other styles but since tie struts are not used in the suspension system, the front cross member is used as a fastening location for radiator cradle mounts only.

A detachable cross member is located behind the engine and transmission assembly to mount the torsion bars for the front suspension.

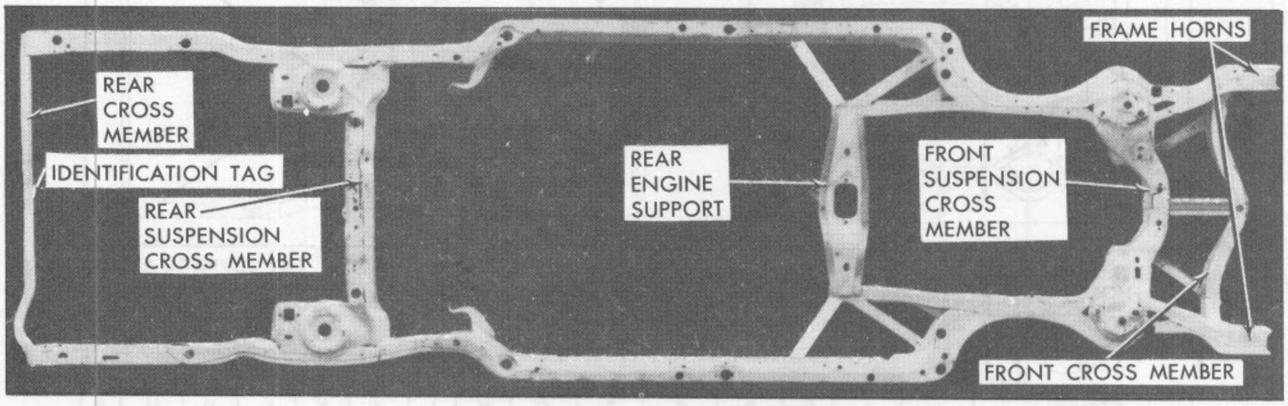


Fig. 2-1 Frame (Except Eldorado)

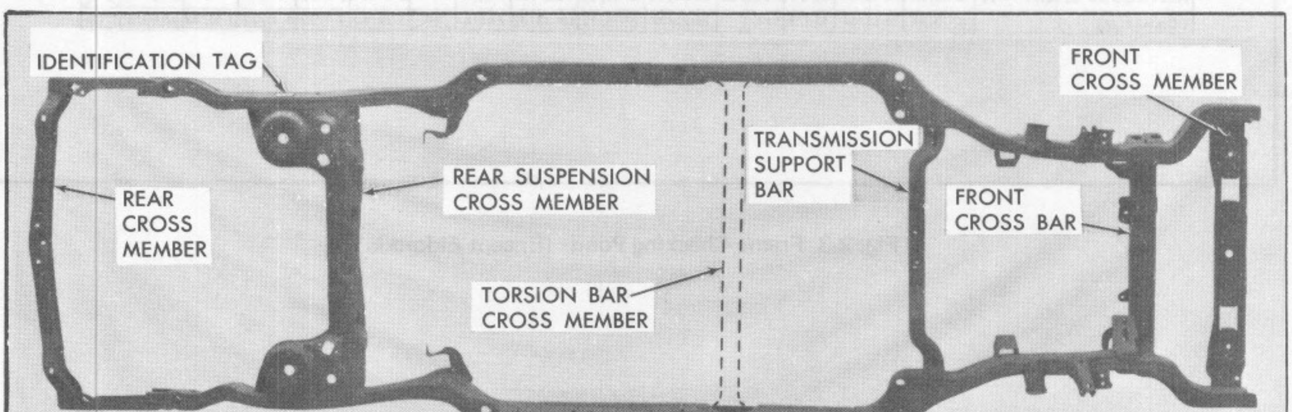


Fig. 2-2 Eldorado Frame

SERVICE INFORMATION

1. Checking Frame for Twist

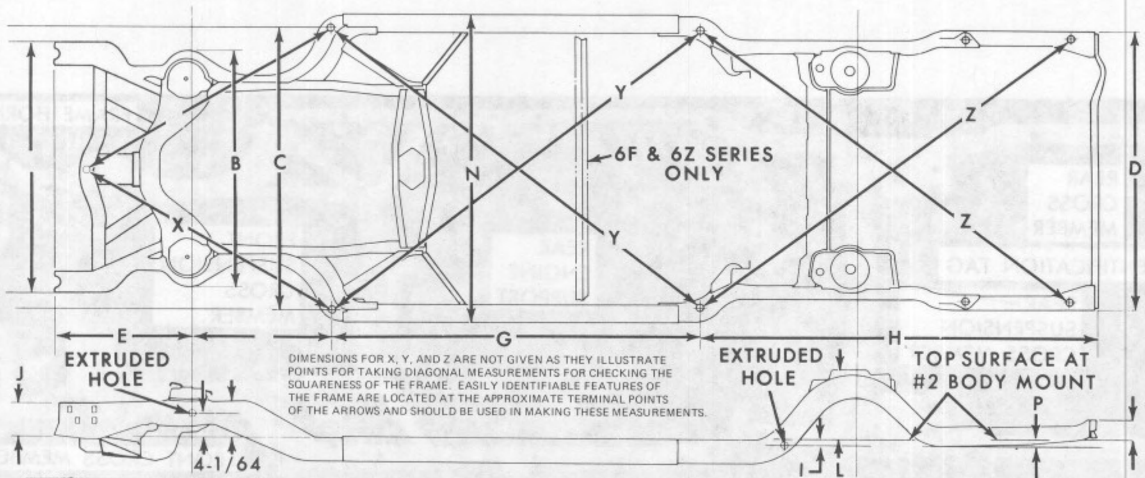
1. Place car on section of level floor, and inflate tires to proper pressure.
2. Measure distance from top of extreme front end of left side rail to floor. Repeat measurement for right side rail.
3. If front ends of right and left side rails are not the same distance from floor, raise low side rail with a jack until distances are equal.
4. Measure distance from extreme rear end of top of left rear side rail to floor. Repeat for right side rail.

2. Checking Frame Dimensions

Refer to frame checking locations, Fig. 2-3, (Fig. 2-4 for Eldorado). The car should be on a flat, level floor to assure accurate measurements when either of the following methods are used.

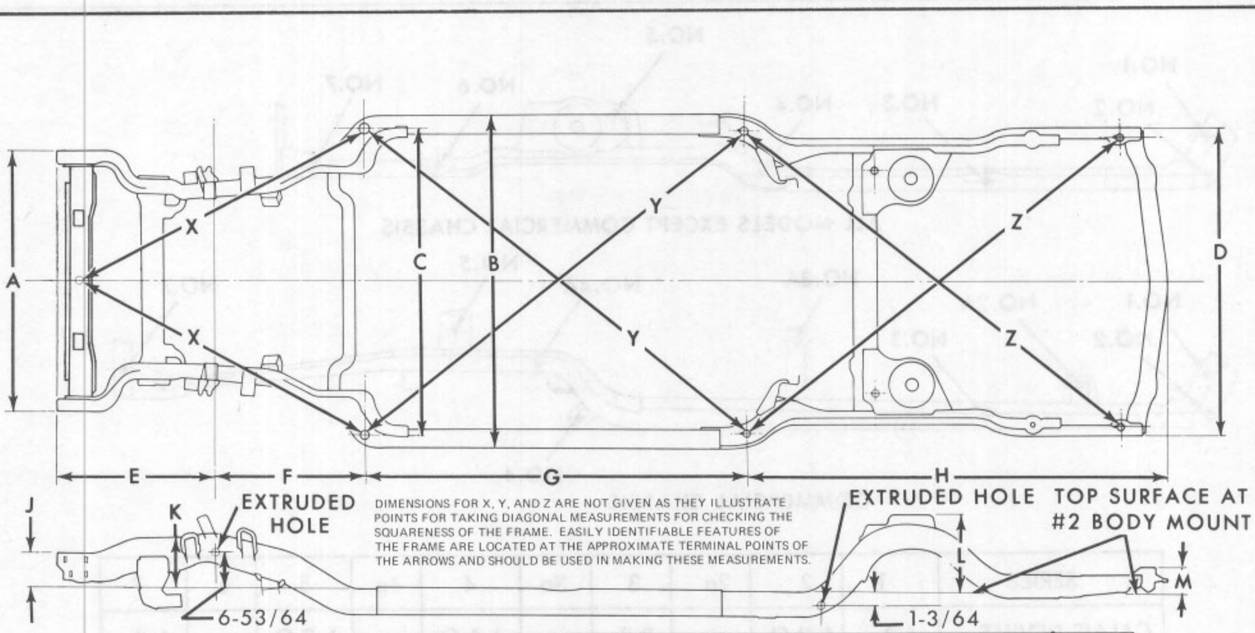
The easiest and most accurate method of checking frame dimensions is by use of tram gages. When using tram gages, be sure to keep the gage cross bar level to insure accuracy in all measurements.

The "plumb bob" method may be used for measuring frame dimensions if tram gages are not available. Using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed at one of the points and a mark made on the floor exactly under the plumb bob. This operation should be repeated at the other point, and the distance between chalk marks on the floor may be easily measured.



SERIES	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
DEVILLE & CALAIS	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	72-5/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
FLEETWOOD SIXTY SPECIAL	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	75-5/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
FLEETWOOOD SEVENTY-FIVE	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	93-37/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
COMMERCIAL	47-13/64	46-13/64	55-1/8	54-1/2	25-23/32	27-15/32	101-13/32	74-1/4		5-39/64	7-1/32	6-23/32	2-15/32	62-11/16	11/16

Fig. 2-3 Frame Checking Points (Except Eldorado)



A	B	C	D	E	F	G	H	J	K	L	M
46-27/32	59-37/64	55-1/8	54-31/32	28-13/32	27-3/64	68-37/64	75-9/16	5 35/64	9-11/64	13-15/32	3-15/16

Fig. 2-4 Frame Checking Points - Eldorado

GENERAL DESCRIPTION

Body Mounts

Locations of the body mount holes on all cars are shown in Fig. 2-5. Cross sectional views of the parts required for installation of body mounts showing the order of assembly also appear in Fig. 2-5. The code letters in the chart and their corresponding cross sections indicate the installation required at the body mount locations for each body style.

SERVICE INFORMATION

3. Body Mounts—#1 through #3a. —Except Eldorado

(Note: Perform procedure exactly as specified regardless of whether all or only one of these mounts is to be replaced, or damage to sheet metal or other components could result.)

a. Removal

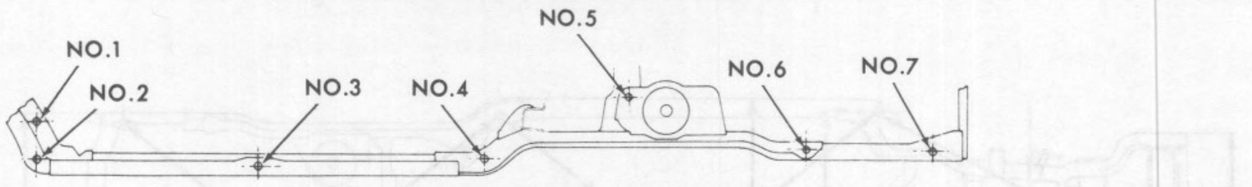
1. Disconnect negative battery cable.
2. Raise car.
3. Remove screws securing wheelhousing splash shields to bumper and frame on each side of car.
4. Remove bolts and nuts securing radiator cradle cross rods to frame horns and make sure rods are out of way.
5. On limousines and Commercial Chassis, remove nut, two grommets, spacer, and two retainers securing each support rod to bumper outer end support brackets.
6. Remove two screws securing power steering gear to frame and loosen third screw. Loosen pinch bolt at flex coupling.
7. Remove mounting bolts (and pads if necessary) from all three radiator cradle mounts.
8. Remove mounting bolts and lower pads from all #1 through #5 body mount locations. Store pads and bolts so they can be identified for reinstallation in same locations.

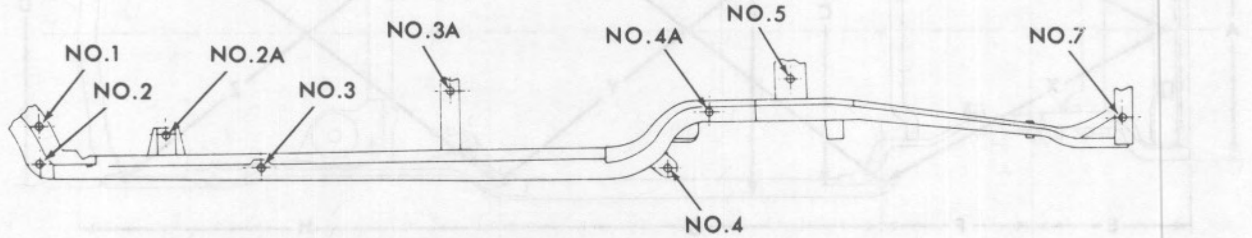
NOTE: See Fig. 2-5 to determine which locations are applicable to body style being worked on.)

9. Place jack stands under body side rails near the #4 locations.
10. Lower chassis until separation between body and frame is barely sufficient to slip out upper pads to be replaced.

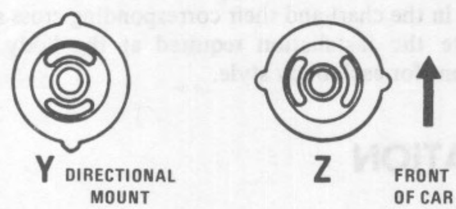
CAUTION: Do not separate body and frame more than necessary as damage to sheet metal and other components could result.

11. Remove all upper pads that require replacement.



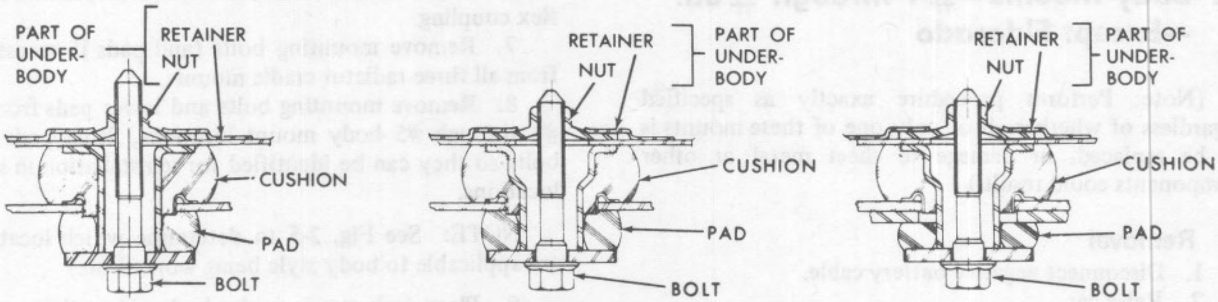


SERIES	1	2	2a	3	3a	4	4a	5	6	7
CALAIS-DEVILLE	A-1	A-2-O	—	B-Z	—	A-1-O	—	A-2-O	—	A-2
BROUGHAM	A-1-Y	A-1-Y	—	B	—	A-1-O	—	A-1-O	—	A-2
ELDORADO COUPE	A-2-O	A-1-Y	—	—	—	A-1-Y	—	—	A-2	A-2-Z
ELDORADO CONVERTIBLE	A-2-O	A-1-Y	—	B	—	A-1-Y	—	—	A-2	A-2-Z
FLEETWOOD "75"	A-1	A-1-O	—	B	—	A-1	—	A-1	—	A-2
COMMERCIAL	A-1	A-1	A-2	C	A-2	A-1	A-1	A-1	—	A-2



A SPECIAL SELF-TAPPING BODY-TO-FRAME BOLT, HAVING A "TAP TIGHT THREAD," IS RELEASED FOR SERVICE. IT ENABLES REPAIR OF STRIPPED THREADS IN BODY MOUNT "T" NUTS WITHOUT HAVING TO CUT HOLES IN THE FLOOR PAN TO REPLACE THE DAMAGED NUT.

	SIZE	TIGHTEN TO
ALL BOLTS	7/16-14	45-60 FT. LBS.



BODY MOUNT "A"
(A-1 DIA. 2.75")
(A-2 CUSHION DIA. 2.50")
(BOLT LENGHT 3.09")

BODY MOUNT "B"
(CUSHION DIA. 2.50")
(BOLT LENGTH 2.88")

BODY MOUNT "C"
(THIN PAD)
(BOLT LENGTH 2.88")

A-1-0(NO REBOUND PAD USED AT THESE POSITIONS
A-2-0(USE WASHER UNDER HEAD OF BOLT

Fig. 2-5 Body Mounts and Locations

b. Installation

1. Install new upper pads as required. Use shims (if any) found on disassembly.

2. Raise chassis until body is lifted from jack stands. Attempt to rotate upper pads with fingers. If any pad can be moved, separate frame and body and add shims as required.

3. Remove jack stands.

4. Install mounting bolts and lower pads at all applicable locations from front of car through #5 mount. Tighten all bolts uniformly to 55 foot-pounds.

5. Position steering gear and secure to frame with three screws, tightening to 55 foot-pounds. Tighten flex coupling pinch bolt to 30 foot-pounds.

> *CAUTION: These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

6. On Limousines and Commercial Chassis, install two retainers, one spacer, two grommets, and nut securing each support rod to each bumper outer end support bracket.

7. Install three radiator cradle mounts.

8. Secure radiator cradle cross rods to frame horns.

9. Secure wheelhousing splash shields to frame and to tab on bumper lower outer ends.

10. Lower car.

11. Install negative battery cable, tightening screw to 70 inch-pounds.

4. Body Mounts—#3 through #7 Locations, Left or Right— Except Eldorado

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal or other components could result.)

a. Removal

1. Raise car.

2. Remove bolts, flat washers, and nuts securing each rear bumper lower mounting bracket to frame.

3. Remove mounting studs and lower pads from all #3 through #7 body mounts using access holes in underside of frame. Store bolts and pads so that they can be reinstalled at same location.

4. Loosen but do not remove mounting bolts at both #1 locations and both #2 locations.

5. Place jack stands under reinforced portion of underbody near #4 mount locations.

6. Lower chassis until separation between body and frame is barely sufficient to slip out all upper pads to be replaced.

> *CAUTION: If frame and body are separated more than necessary, risk of visible sheet metal damage is greatly increased.*

7. Remove any upper pads requiring replacement.

b. Installation

1. Position new upper pads at all locations requiring pad replacement. Install same shims (if any) found on disassembly between pad and frame.

2. Raise chassis until body is lifted from jack stands. Attempt to rotate all upper pads with fingers. If any pads can be moved, lower chassis and install shims between pad(s) and frame.

3. Remove jack stands.

4. Tighten mounting bolts at #1 and #2 locations to 55 foot-pounds.

See fastener CAUTION in Note 3B.

5. Install lower pads and mounting bolts at same locations as found on disassembly, using new pads and bolts as necessary. Tighten mounting bolts to 55 foot-pounds.

See fastener CAUTION in Note 3B.

(NOTE: Make sure torques on all mounting bolts are even, or rough ride could result.)

6. Align rear bumper lower mounting brackets on frame, install nuts, bolts and flat washers securing each mounting bracket to frame, and tighten to 80 foot-pounds.

7. Lower car.

5. Eldorado Body Mounts—#1 or #2 Locations (Left or Right)

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal components could result.)

a. Removal

1. Disconnect negative battery cable and raise car.

2. Remove radiator cradle mounts from frame front cross member.

3. Remove nut, two grommets, spacer, and two retainers securing each support rod to bumper outer end support brackets.

4. Remove screw and washer securing each wheelhousing splash shield to frame.

5. Remove bolts and body mount lower pads from #1, #2, and #3 locations on each side of car. Loosen body mount bolt at each #4 location.

6. Place jack stands under body side rails approximately midway between #1 body mount and torsion bar cross member.

7. Lower frame carefully until separation between

frame and body is barely sufficient to slip out all upper pads to be removed.

See body mount CAUTION in Note 3A.

b. Installation

1. Install new upper pads in all #1 and #2 locations requiring mount replacement. Install same shims found on disassembly.

(NOTE: When installed, pad must be rotated so that two crescent-shaped slits in undersides of #1 and #2 mounts near spacer tube are in a "fore and aft" orientation.)

2. Make sure upper pads at both #3 locations are in position and raise frame until it is supporting body. Recheck all #1, #2, and #3 upper pads to make sure holes line up with mounting holes in frame. Attempt to rotate upper pads. If any pads can be moved, lower chassis and install additional shims.

3. Install lower pad and mounting bolt assemblies at all #1, #2, and #3 locations. Tighten mounting bolts to 55 foot-pounds. Make sure torques are even or rough ride can result.

See fastener CAUTION in Note 3B.

4. Tighten mounting bolts at #4 locations to 55 foot-pounds.

See fastener CAUTION in Note 3B.

5. Secure wheelhousing splash shields to their respective frame rails with one screw and washer each.

6. Install radiator cradle mounts.

7. Install support rods in mounting brackets at outer ends of front bumper.

8. Install negative battery cable tightening to 70 inch-pounds.

6. Eldorado Body Mounts—#3 through #7 Locations, Left or Right

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal or other components could result.)

a. Removal

1. Raise car.

2. Remove two bolts, four flat washers, and two nuts securing each rear bumper lower mounting bracket to frame.

3. Remove mounting studs and lower pads from all #3 through #7 body mounts (ten total) using access holes in underside of frame. Store bolts and pads so that they can be reinstalled at same location.

4. Loosen but do not remove mounting bolts at both #1 locations and both #2 locations.

5. Place jack stands under reinforced portion of underbody forward of each rear lower control arm bracket and inboard of frame side rails.

6. Lower chassis until separation between body and frame is barely sufficient to slip out all upper pads to be replaced.

See body mount CAUTION in Note 3A.

7. Remove any upper pads requiring replacement.

b. Installation

1. Position new upper pads at all locations requiring pad replacement. Install same shims (if any) found on disassembly between pad and frame.

(NOTE: If replacing pads at either #4 location or either #7 location, pads require specific orientation. Two crescent-shaped slots appear on underside of pad near spacer tube. At #4 locations pads must be installed so that slots are in fore and aft position. At #7 locations, slots must be in lateral, i.e., cross-car, position.)

2. Raise chassis until body is lifted from jack stands. Attempt to rotate all upper pads with fingers. If any pads can be moved, lower chassis and install shims between pad(s) and frame.

3. Remove jack stands.

4. Tighten mounting bolts at #1 and #2 locations to 55 foot-pounds.

See fastener CAUTION in Note 3B.

5. Install lower pads and mounting bolts at same #3, #4, #5, #6, and #7 locations as found on disassembly, using new pads and bolts as necessary. Tighten mounting bolts to 55 foot-pounds.

See fastener CAUTION in Note 3B.

(NOTE: Make sure torques on all mount bolts are even, or rough ride could result.)

6. Align rear bumper lower mounting brackets on frame, install two nuts and bolts and four flat washers securing each mounting bracket to frame, and tighten to 80 foot-pounds.

See fastener CAUTION in Note 3B.

7. Lower car and connect negative battery cable, tightening to 70 inch-pounds.

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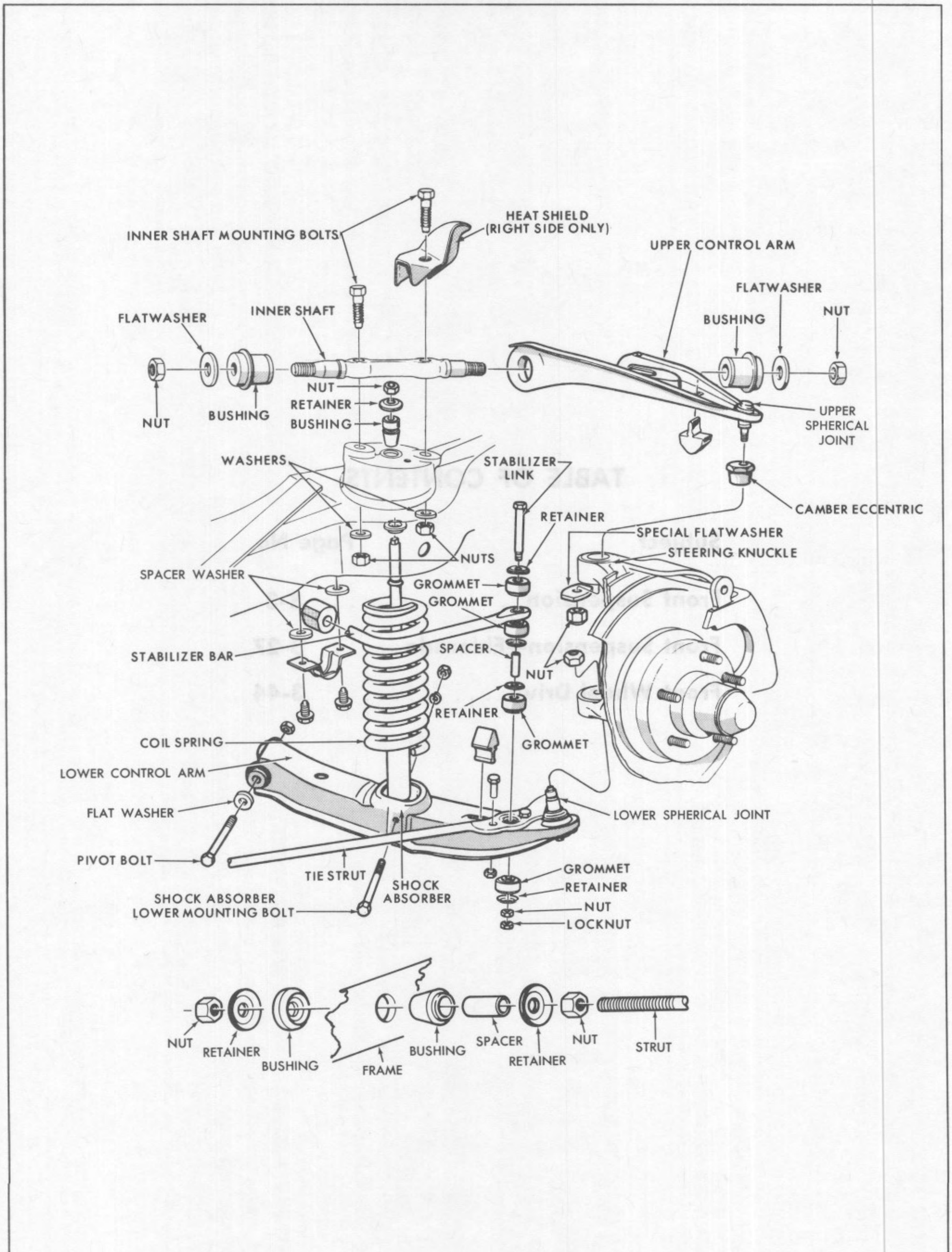


Fig. 3-1 Front Suspension Disassembled

FRONT SUSPENSION—EXCEPT ELDORADO GENERAL DESCRIPTION

All models except the Eldorado use an independent spring type front suspension system, consisting of two upper and two lower control arm assemblies, steel coil springs, shock absorbers, front diagonal tie struts, a stabilizer bar, and two integral steering knuckles, Fig. 3-1. The system is designed so that the geometry of the upper and lower suspension arms produces an anti-dive reaction during braking.

The front suspension used on the Eldorado is described on Page 3-27.

Front Suspension System

a. Spherical Joints

Spherical joints are used at the outer ends of the upper and lower control arms. These joints are packed with lubricant and sealed at assembly, and should not require further lubrication throughout their service life under normal driving conditions. The only maintenance they normally require is an inspection of the seals for physical damage each time the engine oil is changed.

Steel service plugs are provided in the spherical joint covers so that the joints may be packed in the event a seal should become damaged and require replacement. Both the seals and plugs are serviceable.

The upper spherical joint is pressed into the upper suspension arm and tack-welded to the arm at two points. It connects the upper suspension arm to the steering knuckle through a camber adjustment eccentric. Camber adjustment is made by turning this eccentric to move the steering knuckle in or out at the top. The lower spherical joint, a tension type joint, is pressed into the lower suspension arm. It connects the lower suspension arm to the steering knuckle.

The spherical joints are designed to allow both the up-and-down movement of the wheel due to road irregularities, and the pivoting movement that takes place as the wheels are turned while steering.

b. Compression and Rebound Bumpers

A rubber compression bumper on the lower suspension arm limits upward travel of the suspension system and a rubber rebound bumper on the upper suspension arm limits downward travel. Both bumpers are held in place by means of a pull-through tab.

c. Tie-Struts

Diagonal tie-struts are used on the front suspension system to control the fore and aft movement of the wheels. The struts are bolted to the outer ends of the lower suspension arms just inboard of the spherical joints, and extend forward through the frame strut rod support member. At this point, the struts are threaded and secured by two locknuts. These locknuts also control caster adjustment. The attachment is cushioned by rubber bushings and steel retainers. The tie struts are interchangeable right and left.

d. Suspension Arms

The upper suspension arms pivot at their inner ends on two flanged rubber bushings, one at each end of the one-piece suspension arm shaft, which is bolted to the top surface of the frame spring tower. Upper suspension arm shafts are interchangeable right and left. The lower suspension arms pivot on a single rubber bushing that is bolted to the front suspension frame cross member.

The upper suspension arms and spherical joints tack welded in assembly are not interchangeable left and right. Upper arms and spherical joints prior to assembly are interchangeable between left and right sides. The lower suspension arms are not interchangeable, but their spherical joints are interchangeable.

e. Steering Knuckle

The integral steering knuckle is a combination steering knuckle, brake caliper support, and steering arm.

The steering knuckle is mounted to the tapered spherical joint studs at the outer ends of the upper and lower suspension arms. The splash shield is secured to the steering knuckle with three attaching screws.

The integral steering knuckles are not interchangeable right and left.

f. Stabilizer Bar

A front stabilizer bar is used to provide steering stability and to control body roll. The stabilizer bar is mounted on the frame front side rails forward of the suspension arms and is connected to the lower suspension arms by steel links that are cushioned at each end in rubber bushings. The stabilizer bar extends across the car between its frame mounts.

g. Springs and Standard Shock Absorbers

The front wheels are controlled in their up-and-down movement by steel coil springs and direct, double acting, permanently sealed shock absorbers.

The springs are mounted with the lower ends seated on the lower suspension arms and the upper ends seated in towers on the front suspension frame cross member.

(NOTE: To effectively control bumper heights, springs for all models are computer selected according to vehicle weights including all accessories. When replacing springs, be certain to select the proper spring as listed in the Cadillac Parts Manual.)

The standard shock absorbers incorporate a Teflon piston ring for improved piston sealing with temperature variations in the shock. These shock absorbers provide efficient and constant damping control because oil is separated from air in the reservoir, which eliminates aeration of oil and prevents lag. Separation is accomplished by means of a pliacell envelope filled with an inert gas that takes the place of the air pocket.

The front shock absorbers are positioned in the center of the coil springs and are attached at the upper ends to the spring seat towers. The lower ends are attached to the lower suspension arms by bolts that go through the arms and the lower shock mount sleeves.

FRONT SUSPENSION DIAGNOSIS CHART

Condition	Cause	Correction
Car pulls to one side.	Uneven tire pressure.	Inflate tires to proper pressure.
	Radial tire lateral force. (conicity)	Rotate tires.
	Front wheel alignment out of specification.	Check and adjust as necessary, Section 3, Note 2.
	Uneven standing height, left and right.	Perform procedure in Section 3, Note 1.
	Drag link height incorrect.	Perform procedure in Section 9, Note 5.
	Brakes dragging.	See brake diagnosis.
	Upper or lower suspension arm mounting bolts loose.	Check and correct all fastening torques.
	Wheel bearings adjusted too tight.	Check for binding with front wheels off floor. Adjust and lubricate bearings, Section 3, Note 17.
	Steering gear valve off center.	Replace valve assembly, Section 9, Note 12c.
	Bent Frame.	Check frame for proper alignment and repair as necessary.
Scuffed tires.	Toe-in incorrect.	Adjust as in Note 2d.
	Camber out of specification.	Adjust as in Note 2c.
	Tires improperly inflated.	Inflate to proper pressure.
Cupped tires.	Toe-in incorrect.	Adjust as in Note 2D.
	Excessive wheel and/or tire runout.	Compensate as explained in Section 10, Note 15c.
	Wheels or tires out of balance.	Balance wheels and tires.
	Excessive on-center lash in steering gear.	Perform adjustments in Section 9, Note 4.
	Front shock absorber inoperative.	Replace shock absorber, Section 3, Note 3.

FRONT SUSPENSION DIAGNOSIS CHART (Cont'd.)

Condition	Cause	Correction
Cupped Tires (Cont'd.)	Worn upper spherical joint.	Check joint as in Note 7a. Replace arm and joint assembly if necessary.
	Worn lower spherical joint.	Check joint as in Note 7b. Replace joint if necessary, following procedure in Note 11.
	Excessive (1/4" or more) vertical lash in idler arm frame pivot.	Replace idler arm assembly.
	Wheel bearings worn or incorrectly adjusted.	Adjust or replace bearings as necessary, Note 17.
Front wheel shimmy.	Wheels or tires out of balance.	Balance wheels and tires.
	Wheels or tires out of round.	Compensate for runout as described in Section 10, Note 15c.
	Rough or cupped tire.	Isolate and replace.
	Steering gear or steering connections incorrectly adjusted or worn.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Front wheel bearings incorrectly adjusted or worn.	Adjust or replace as required.
	Shock absorbers weak or inoperative.	Check and replace if necessary.
Car wanders	Improper tire inflation.	Inflate to proper pressure.
	Steering gear or connections adjusted too loosely or worn.	Adjust or install new parts as necessary.
	Drag link height or parallelism incorrect.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Toe-in or caster incorrectly adjusted.	Adjust toe-in and caster.
	Mixed tire brands.	Replace tires so that all are identical brand and type.
	Excessive friction in front suspension.	Check spherical joint seals for damage. If necessary, replace seals and repack joints.
Car waddles (5 to 20 Mph)	Radial tire lateral force variation	Replace offending tire (Refer to tire section)

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake system damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

When performing front end alignment or other operations that require loosening the camber eccentric in the knuckle by striking the bottom of the stud, exercise caution to prevent the striking tool from slipping and hitting the brake hose or the spherical joint seal.

When removing the camber eccentric or disconnecting the upper control arm ball stud, never use the brake hose to support or suspend the disc or caliper.

Never attempt to straighten a bent part; replace it with a new part.

The following caution applies to certain steps in the assembly procedure of components in this section. The critical fasteners to which this caution applies are identitied by the terminology *"Caution: See Page 3-6."*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Front Standing Spring Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack and that there is a full tank of gasoline, or use compensating weight as shown in Fig. 3-38, as all specifications are based on this curb weight. Normalize position of springs by bouncing bumper up and down. Slowly reduce the force applied until the car seeks its own level.

a. Front Springs

Measure the distance from the top of the lower control arm in front of the rubber bumper to the flat surface of the bottom of the frame. Standing heights should be equal on both sides of car within 3/8 inch. If heights are unequal, it will be necessary to replace the spring on the low side.

See Fig. 3-2 for checking points and specifications for each series.

b. Ride Complaints

In case of hard riding the first items to investigate are tire pressures, standing heights, and shock absorbers. If these are correct, the amount of friction in the front suspension system should be checked.

The procedure for checking excessive friction in the front suspension is as follows:

1. Disconnect front shock absorbers.
2. With aid of a helper, lift up on the front bumper and raise the front end of the car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from the floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height; again take measurement at same point on bumper.

If the difference between these two measurements is 1-1/4 inch or more, it indicates excessive friction in the suspension system. Probable causes include damaged seals on the spherical joints permitting dirt and water in the joints, bound up steering linkage, or excessive binding in the stabilizer bar mounting bushings.

2. Front Wheel Alignment (Fig. 3-3)

Satisfactory vehicle operation may occur over a wide range of front end (wheel) alignment settings. Nevertheless, should settings vary beyond certain tolerances, readjustment of alignment is advisable. The specifications stated in column 1 of the specifications chart should be used by owners, dealers, and repairmen as guidelines in vehicle diagnosis either for repairs under the new vehicle warranty or for maintenance service at customer's request. These specifications provide an acceptable all-around operating range in that they prevent abnormal tire wear caused by wheel alignment.

Governmental Periodic Motor Vehicle Inspection programs usually include wheel alignment among items that are inspected. To provide useful information for such inspections, the specifications stated in column 2 of the specification chart are given and these are well within the range of safe vehicle operation.

In the event the actual settings are beyond the specifications set forth in column 3 or 4 (whichever is applicable), or whenever for other reasons the alignment is being reset, Cadillac recommends that the specifications given in columns 1 and 2 of the specification chart be used.

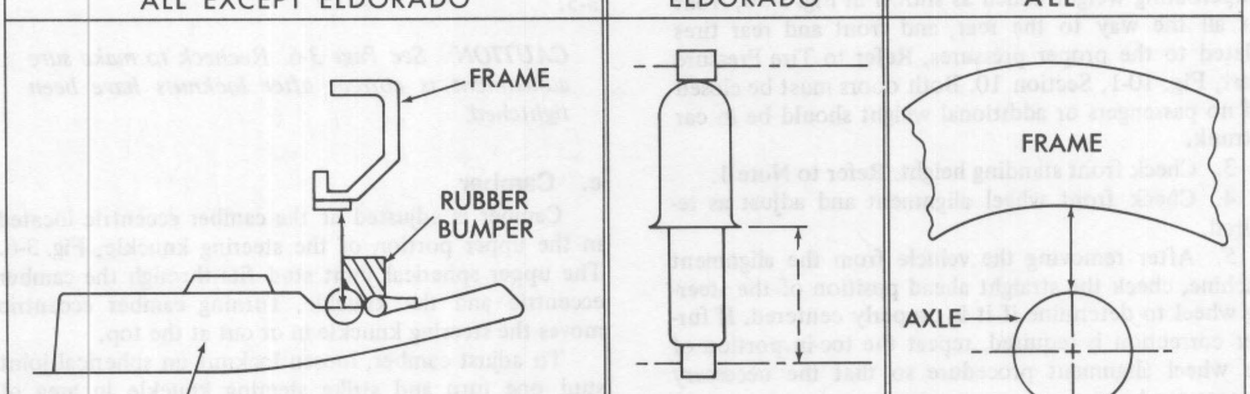
a. Sequence of Operations

Front wheel alignment must be checked whenever the standing height is changed due to a spring replacement, removal and installation of an upper control arm assembly, a lower control arm, tie-strut, or a steering knuckle.

VEHICLE STANDING HEIGHTS			
STYLE		FRONT STANDING HEIGHT (INCHES)	REAR STANDING HEIGHT (INCHES)
CALAIS COUPE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
CALAIS SEDAN	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
COUPE DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
SEDAN DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
FLEETWOOD BROUGHAM	STANDARD	3-7/8 TO 4-5/8	4-7/8 TO 5-5/8
FLEETWOOD 75 SEDAN	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
FLEETWOOD 75 LIMO	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
ELDORADO COUPE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16
ELDORADO CONVERTIBLE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16

CHECKING POINTS

ALL EXCEPT ELDORADO | ELDORADO | ALL



FRONT | REAR

Fig. 3-2 Checking Standing Heights

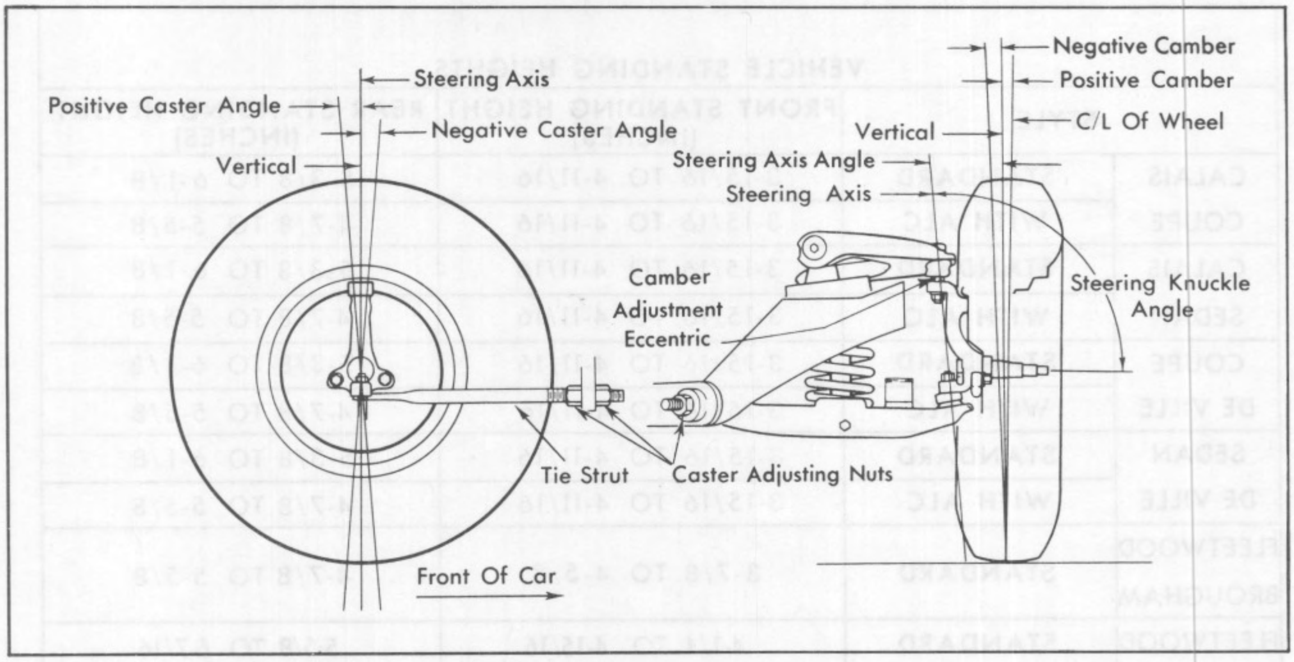


Fig. 3-3 Elements of Front Wheel Alignment

Wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment equipment. These instruction should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

1. Check straight ahead position of steering wheel by driving vehicle a short distance. Place a piece of tape on steering wheel at straight ahead position of wheel for future reference, so that any correction needed can be made during the toe-in adjustment.

2. Car must be on a level surface, gas tank full or a compensating weight added as shown in Fig. 3-38, front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure Chart, Fig. 10-1, Section 10. Both doors must be closed and no passengers or additional weight should be in car or trunk.

3. Check front standing height. Refer to Note 1.

4. Check front wheel alignment and adjust as required.

5. After removing the vehicle from the alignment machine, check the straight ahead position of the steering wheel to determine if it is properly centered. If further correction is required, repeat the toe-in portion of the wheel alignment procedure so that the necessary changes can be made.

b. Caster

Caster adjustment is obtained by shortening or lengthening the tie-struts between the lower suspension arms and frame strut rod support member to tilt the vertical steering axis of the knuckle. Tilting toward the front of the vehicle results in negative caster – toward the rear, positive caster.

Before adjusting caster, loosen tie-struts at lower suspension arms. This will allow tie-strut to center itself and prevent damage to bushings and premature wear at frame strut rod support member.

To provide more negative caster, lengthen tie-struts by loosening front locknuts and tightening rear locknuts. One turn of locknuts results in approximately 1/2° change in caster. Use J-24515 caster adjusting wrench to loosen and tighten rear caster adjusting nut.

To provide more positive caster, shorten tie-struts by loosening rear locknuts and tightening front locknuts.

After proper caster adjustment has been made, tighten tie-strut mounting bolt nuts at lower arms to 55 foot-pounds, and front locknuts to 50 foot-pounds, Fig. 3-5.

CAUTION: See Page 3-6. Recheck to make sure adjustment is correct after locknuts have been tightened.

c. Camber

Camber is adjusted at the camber eccentric located in the upper portion of the steering knuckle, Fig. 3-6. The upper spherical joint stud fits through the camber eccentric and the knuckle. Turning camber eccentric moves the steering knuckle in or out at the top.

To adjust camber, loosen locknut on spherical joint stud one turn and strike steering knuckle in area of spherical joint stud to free camber eccentric in steering knuckle, Fig. 3-7.

CAUTION: Use extreme care to prevent the striking tool from slipping and damaging either the brake hose or the spherical joint seal.

Using Camber Adjustment Wrench, J-23415, Fig. 3-8, turn camber eccentric until desired camber is obtained.

Final position of joint stud should be in rear portion of camber eccentric in order to keep steering arm angle

C–CAR WHEEL ALIGNMENT SPECIFICATIONS*

	SPECIFICATIONS FOR RESETTING ALIGNMENT		TOLERANCE FOR DIAGNOSIS FOR WARRANTY REPAIRS OR CUSTOMER PAID SERVICE	TOLERANCE FOR PERIODIC MOTOR VEHICLE INSPECTION
Tire Used	L78–15/B or LR78–15/B	L78–15/D or LR78–15/D		
Series	All Exc 75's	Fleetwood 75's		
Camber	LH $0^\circ \pm 3/8^\circ$ RH $-1/4^\circ \pm 3/8^\circ$	LH $0^\circ \pm 3/8^\circ$ RH $-1/4^\circ \pm 3/8^\circ$	$\pm 3/4^\circ$	$\pm 1\ 1/2^\circ$
Cross Camber (LH Minus RH)	$1/4^\circ \pm 1/2^\circ$	$1/4^\circ \pm 1/2^\circ$	$\pm 1^\circ$**	–
Caster	$0^\circ \pm 1/2^\circ$	$-1^\circ \pm 1/2^\circ$	$\pm 1^\circ$	$\pm 2^\circ$
Cross Caster (LH Minus RH)	$0^\circ \pm 1/2^\circ$	$0^\circ \pm 1/2^\circ$	$\pm 1^\circ$**	–
Toe-In	1/8" ± 1/16"	1/8" ± 1/16"	± 1/8"	± 3/8"

*Vehicle must have full lubricant, coolant and fuel levels with no passengers or luggage.

**Cross camber and cross caster not to exceed 1° maximum per vehicle.

Fig. 3-4 C-Car Wheel Alignment Specifications

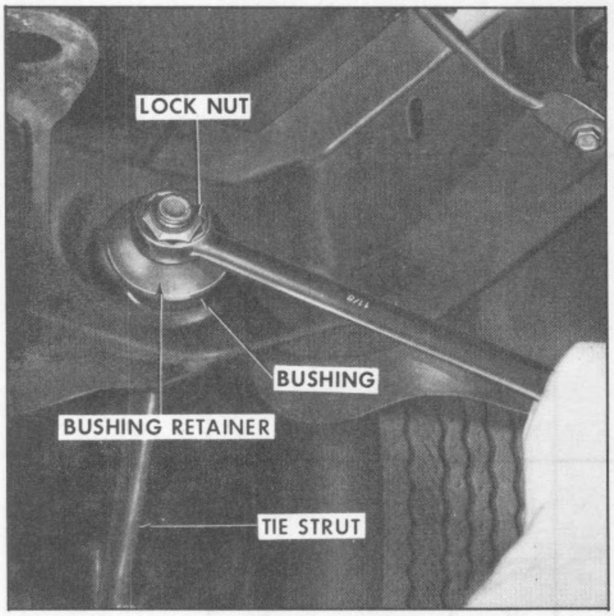


Fig. 3-5 Adjusting Caster

Fig. 3-7 Loosening Camber Eccentric

correct. Tighten locknut on spherical joint stud to 60 foot-pounds.

CAUTION: See Page 3-6.

d. Toe-In

Before checking toe-in, make certain that drag link height is correct. See Section 9, Note 5, for drag link height.

The readings should be taken only when the front wheels are in a straight ahead position so that the steering gear is on its high spot.

Toe-in is adjusted by turning the tie rod adjuster tubes at outer ends of each tie rod after loosening clamp bolts.

CAUTION: To prevent damage to the tubes, do not use a pipe wrench or heavy tool to free tie rod adjuster tubes if they are seized, rusted, or corroded. If necessary, use penetrating oil or pry tie rod adjuster tubes open with a flat bladed tool. Replace tie rod adjuster tubes, or tie rod outer pivots if damaged. If torque required to remove nuts from bolt after breaking nut loose exceeds 84 inch-pounds, discard nut and bolt.

The tie rod adjuster tubes should be lubricated with chassis lubricant if disassembled from tie rods for any reason. When turning adjuster tubes, be

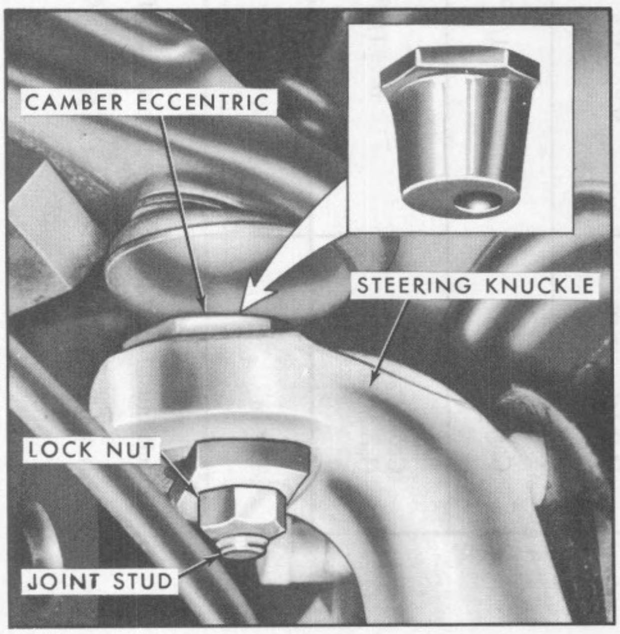


Fig. 3-6 Camber Adjusting Eccentric

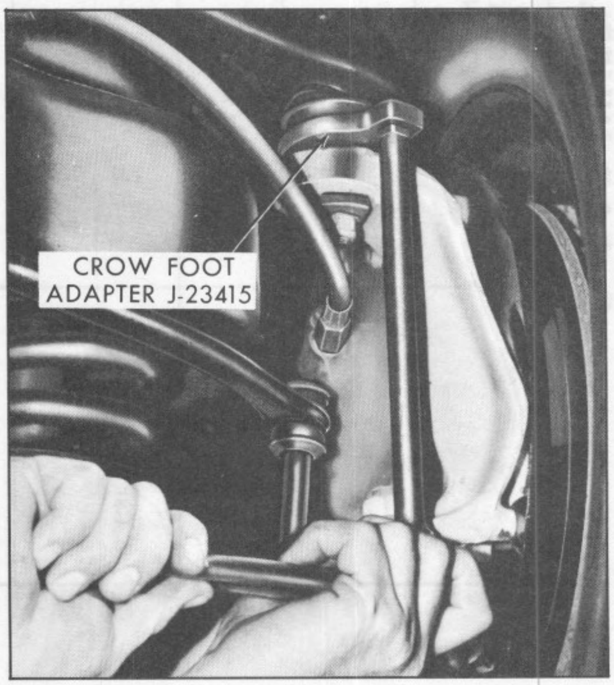


Fig. 3-8 Adjusting Camber

careful not to turn tie rod ends so that they bottom out, as seals could become pinched between stud and socket and become damaged. If this happens, the entire pivot must be replaced.

Be sure to turn both adjuster tubes an equal amount when adjusting toe-in so that relation of steering gear high spot to straight ahead position of front wheels will not be changed.

When adjustment has been completed according to recommended specifications, tighten nuts on clamp bolts to 22 foot-pounds.

Both the tie rod ends and joint studs should be in a centralized position before tightening clamps. Check relationship between jaws of clamp and slot in adjuster tube. Do not allow corner of one to catch on a corner of the other, Fig. 3-9.

Each tie rod should be checked after adjustment by grasping the center of the tie rod and rotating the rod assembly.

The movement should be through an angle of 20 to 30 degrees total. If not, it is an indication that the pivot studs are not properly positioned. If tie rods are not properly positioned, a binding condition may occur, resulting in poor return of wheels to straight ahead position. Also check steering linkage joints for looseness. Replace inner or outer tie rod pivot if loose.

3. Front Shock Absorbers

a. Removal

1. Raise hood and remove shock absorber upper retaining nut and retainer at frame spring tower. The shock absorber upper stem is square at the top so that it may be held by a wrench to prevent stem from turning when removing nut.

2. Remove bolt, nut, and lockwasher holding lower end of shock absorber to lower suspension arm.

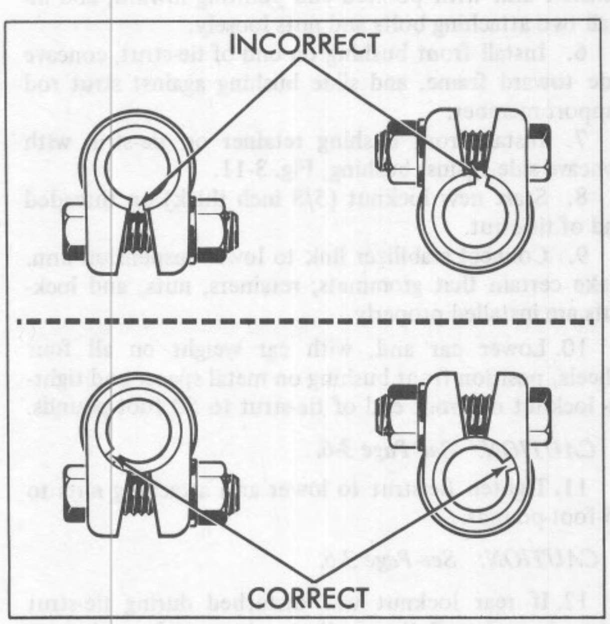


Fig. 3-9 Tie Rod Clamp Position

3. Remove shock absorber through bottom of lower arm.

b. Installation

1. If new grommet is required, dip grommet in a soapy water solution and force grommet through frame hole with a twisting motion.

CAUTION: Do not use silicone lubricant. The soapy water will dry and allow the grommet to seal. Silicone will not.

2. Install retainer on shock absorber upper stem, and fully extend shock absorber rod.

3. Insert shock absorber assembly up into coil spring and guide stem through grommet. Then place lower end in position on lower suspension arm, and install bolt, lockwasher, and nut. Tighten bolt to 55 foot-pounds.

4. Install retainer and nut on shock absorber upper stem, and tighten nut to 180 inch-pounds, while holding stem from turning with wrench.

4. Checking Front Shock Absorbers

1. Check all tire pressures.
2. Check shock absorber mounting torques.
3. If possible, road test car to determine the exact nature of the problem.
4. Quickly alternate pushing down and lifting left front corner of bumper. Repeat process for right front corner. The feeling of resistance should be equal between right and left. If so, it is unlikely that either shock requires replacement. If noticeable variation is felt, proceed to Step 6.
5. Visually inspect shock absorbers. If oil is detected, check for leaks in power steering system, transmission cooler lines, etc.

(NOTE: A slight trace of shock fluid is not cause for replacement as the seal permits some seepage from fluid reserve for piston rod lubrication.)

6. Raise car and remove one shock absorber.
7. Clamp shock absorber upside down in vise.

(NOTE: Cadillac shock absorbers can be turned upside down because all internal vapor, inert gas instead of air, is contained in a pliacell envelope which prevents aeration of oil and prevents lag. "If a lag is noticed when stroked, it means the pliacell envelope has been ruptured and the shock should be replaced".)

8. Pump shock by hand at various rates of speed and observe resistance. Resistance should be smooth and constant.

(NOTE: Rebound resistance is approximately twice as strong as that of compression.)

9. Compare resistance felt with that of a unit known to be good. The following conditions are abnormal and require replacement of shock absorber:

a. A skip or lag at reversal near mid-stroke.
b. A seize (except at either extreme of travel)

c. A grunt or squeal after completion of one full stroke in each direction.

d. A clicking noise at fast reversal.

e. Fluid leakage.

A skip at full extension with shock absorber inverted, or a faint hiss ("orifice swish") are normal conditions and do not indicate necessity of shock absorber replacement.

5. Stabilizer Bar

a. Removal

1. Remove nuts, retainer, and grommet from bottom of each stabilizer link, Fig. 3-10.
2. Remove bolts from mounting brackets that hold stabilizer to frame and remove brackets.
3. Remove rubber bushings from stabilizer bar, and remove grommets, retainers, spacers, and links from ends of stabilizer bar.
4. Turn wheels to full stop and work stabilizer bar from car.

b. Installation

1. Position stabilizer bar under front frame side rails and slide rubber bushings in place.

(NOTE: Stabilizer bar grommets and retainers are larger than those used on previous models or on the present shock absorbers. Replacement parts must be of this larger design.)

2. Install mounting brackets over rubber bushings and secure with bolts, Fig. 3-10. Tighten bolts to 35 foot-pounds.
3. Install grommets, retainers, links, and spacers on ends of stabilizer bar, making certain that retainers and grommets are arranged exactly as shown in Fig. 3-10.
4. Install grommet, retainer and nut. Install locknut on bottom of each link. Tighten nuts to 150 inch-pounds.

6. Tie-Strut and Bushings

a. Removal

1. Raise car.
2. Disconnect stabilizer link from lower arm on side from which tie-strut is to be removed.
3. Remove locknut, bushing retainer, and bushing from forward end of tie-strut, Fig. 3-11.

(NOTE: If replacing only bushings, do not disturb rear locknut on tie-strut, otherwise it will be necessary to readjust caster and camber.

4. Remove two bolts and nuts securing tie-strut to lower suspension arm and remove strut.
5. Remove tie strut from car.
6. Remove rear bushing, spacer, and retainer from tie-strut.
7. Remove rear locknut from tie-strut if necessary.

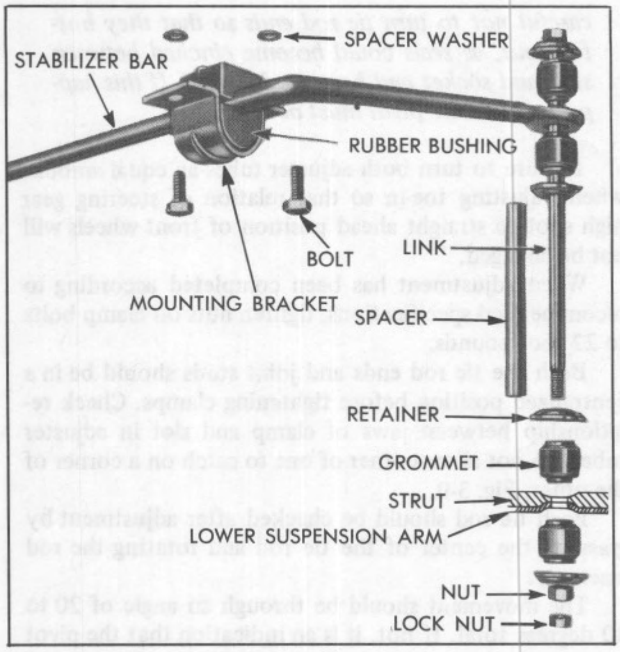


Fig. 3-10 Front Stabilizer Linkage

b. Installation

1. If rear locknut was previously removed, install a new locknut (3/4 inch thick) on threaded end of tie-strut, and run nut approximately 3/4 inch from end of thread. See Fig. 3-1 for correct arrangement of parts.
2. Install rear bushing retainer on tie-strut with concave side against nut.
3. Insert metal spacer part way through conical shaped bushing from small end, and install on tie-strut with small end toward front of car.
4. With tie-strut held in a horizontal position, install threaded end through frame strut rod support member.
5. Position opposite end of tie-strut on lower suspension arm with pointed end pointing inward, and install two attaching bolts and nuts loosely.
6. Install front bushing on end of tie-strut, concave side toward frame, and slide bushing against strut rod support member.
7. Install front bushing retainer on tie-strut with concave side against bushing, Fig. 3-11.
8. Start new locknut (5/8 inch thick) on threaded end of tie-strut.
9. Connect stabilizer link to lower suspension arm. Make certain that grommets, retainers, nuts, and locknuts are installed properly.
10. Lower car and, with car weight on all four wheels, position front bushing on metal spacer and tighten locknut on front end of tie-strut to 50 foot-pounds.

CAUTION: See Page 3-6.

11. Tighten tie-strut to lower arm attaching nuts to 55 foot-pounds.

CAUTION: See Page 3-6.

12. If rear locknut was disturbed during tie-strut removal or installation, adjust caster and camber as described in Notes 2b and 2c.

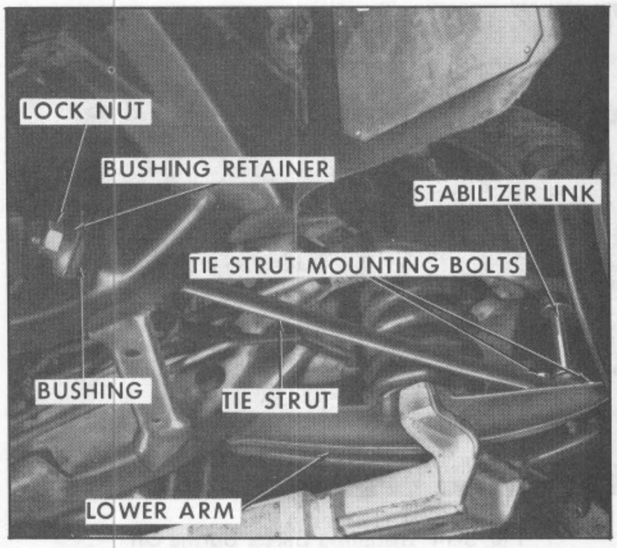


Fig. 3-11 Front Suspension Tie Strut

7. Front Suspension Spherical Joint Checking Procedures

a. Upper Spherical Joints

1. Raise car, place jack stands under lower control arm, and remove wheel and tire assembly. Scribe or punch an alignment mark between steering knuckle and camber eccentric to facilitate reinstallation.

2. Back off upper spherical joint stud locknut approximately two turns. Do not remove locknut. This will prevent hub and rotor from collapsing outward when joint stud is broken free from knuckle.

3. Using a hammer, strike steering knuckle in area of upper spherical joint stud to separate joint and knuckle, Fig. 3-7, then remove locknut and flat washer from stud.

CAUTION: Use extreme care to prevent hammer from slipping and damaging either the brake hose or spherical joint seal.

(NOTE: On some cars, camber eccentric may come out with stud. This is a normal condition.)

4. Lift upper arm to remove spherical joint stud from knuckle.

5. Using regular spherical joint stud nut and a second nut as a locknut, turn joint in its socket with an inch-pound torque wrench. Reading should fall between 24 and 48 inch-pounds. If joint is too tight or too loose, replace joint and upper arm as an assembly.

6. Remove both nuts from stud.

7. Install joint stud in knuckle and install special flat washer and an ordinary nut on stud. Tighten nut to seat joint stud in knuckle.

(NOTE: If camber eccentric separated from knuckle in Step 3, use alignment marks for proper orientation.)

8. Remove nut and install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

9. Install wheel and tire assembly, tightening wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

10. Check camber and caster and adjust if necessary, as described in Notes 2b and 2c.

b. Lower Spherical Joints (Fig. 3-12)

The lower spherical joint on C-cars is inspected for wear visually. Wear is indicated by protrusion of a nipple into which the service plug is threaded. This round nipple protrudes .050" beyond the surface of the spherical joint lower cover on a new, unworn joint. Normal wear will result in the surface of this nipple retreating very slowly inward.

To inspect for wear, clean all road deposits from the spherical joint lower cover and service plug. Carefully observe the position of the nipple relative to the lower cover. If the nipple is flush with, or inside the cover surface, replace the spherical joint.

(NOTE: Spherical joint service set, J-9519-02 available at dual dealers may be used to install the front lower C-car spherical joints.)

8. Front Upper Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise front end of car and place jack stands under lower suspension arms.
2. Remove wheel and tire assembly.
3. Loosen upper spherical joint locknut.
4. Scribe a mark on camber eccentric and steering knuckle to facilitate alignment at time of installation.
5. Using a hammer, strike steering knuckle in area of upper spherical joint stud until joint is free from steering knuckle, then remove nut and special flat washer from stud, Fig. 3-7.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

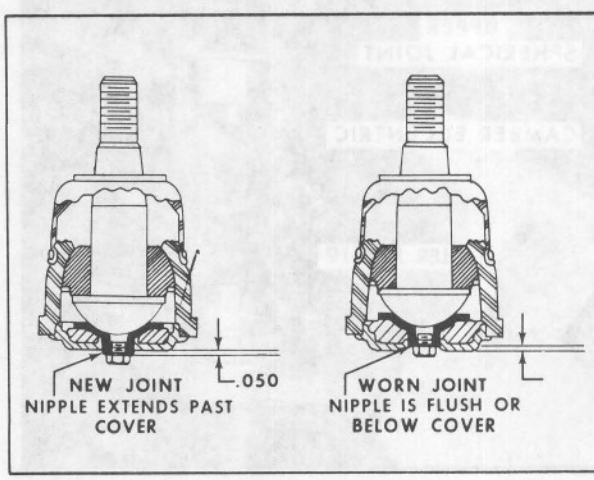


Fig. 3-12 Checking Lower Spherical Joints (C-Car)

6. Raise up on upper arm and remove spherical joint from steering knuckle.

7. Remove camber eccentric from joint stud, using Puller, J-24319, Fig. 3-13.

(NOTE: In cases where camber eccentric is seized or "frozen" to joint stud, remove upper suspension arm assembly, and remove camber eccentric as a bench operation.)

8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.

9. Pry garter spring from seal. Remove and discard seal and spring.

10. Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.

11. Inspect ball pivot for loosening or binding. Note 7. Joint should turn in its socket at 24 to 48 inch-pounds. If spherical joint is damaged or worn, replace joint and arm as an assembly.

12. Unscrew service plug from spherical joint cover.

13. Install new seal on spherical joint. Proceed as follows:

a. Apply a small amount of lubricant, Part No. 1050411 or equivalent, around hole in seal. Wipe groove in joint housing clean and install seal on joint stud. Make certain the large groove diameter of seal engages in recess (circular groove) around joint housing.

b. Allow air to enter seal by momentarily prying large lip of seal away from joint housing with a small screwdriver.

c. Grasp small end of seal and extend toward threaded end of stud.

d. Install new garter spring on the smaller flanged surface of Garter Spring Installer, J-9148, and lubricate inside diameter of installer with suspension lubricant.

e. Install spring on seal using Garter Spring Installer, J-9148, Fig. 3-14. Make certain that spring secures lip of seal in recess all around joint housing.

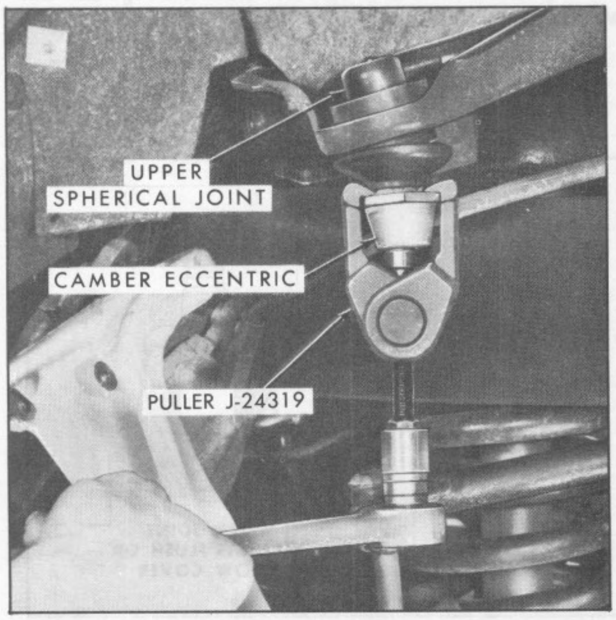


Fig. 3-13 Removing Camber Eccentric

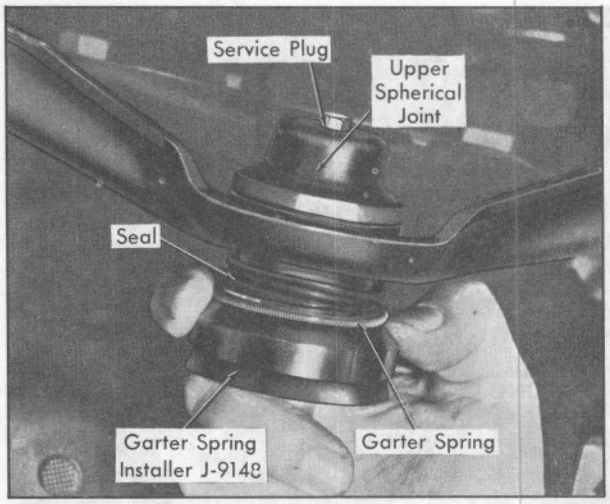


Fig. 3-14 Installing Garter Spring On Upper Spherical Joint Seal

(NOTE: If spring should separate where it is joined together, it is not an indication that the spring is broken. Join spring ends together and lock by twisting male end counterclockwise approximately 2-3 turns. Ends will thread into each other upon releasing.)

14. Using Repacking Gun, J-9280, and Adapter, J-9280-5, apply lubricant, Part No. 1050411 or equivalent, until approximately two teaspoons of lubricant escapes under the seal at the screwdriver, Fig. 3-15. Any water trapped in the joint should be forced out by the fresh lubricant.

CAUTION: Make certain that proper type lubricant is used when repacking suspension joints as use of other lubricant may not provide sufficient lubrication.

15. Install service plug in spherical joint cover, tightening to 48 inch-pounds.

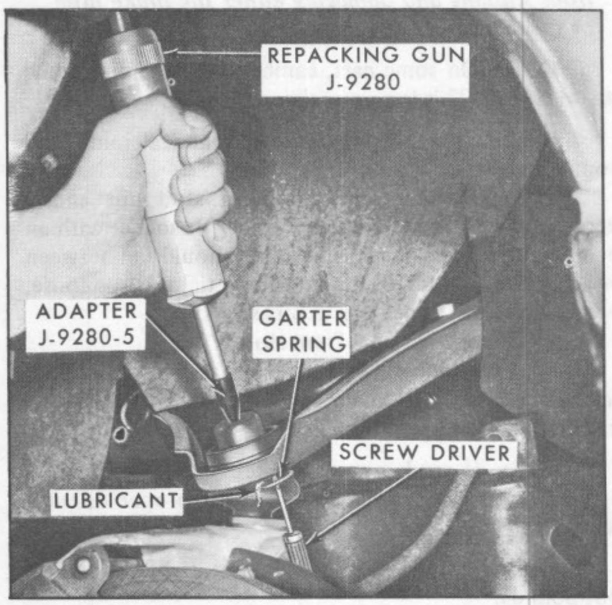


Fig. 3-15 Repacking Front Upper Spherical Joint Seal

16. Apply a light coating of grease on outside taper of camber eccentric and install camber eccentric on joint stud.

17. Thoroughly clean inside of steering knuckle and install joint stud and camber eccentric in steering knuckle, remembering to align scribe marks on eccentric and knuckle.

18. Install special flat washer and standard 1/2"-20 nut on joint stud and tighten nut until camber eccentric locks in knuckle; then remove standard nut, holding flat washer in place, and install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

19. Install wheel and tire assembly, remove jack stands, and lower car.

20. Check camber and caster and adjust if necessary, following Notes 2b and 2c.

9. Repacking Front Lower Suspension Arm Spherical Joint Seal

1. Raise car.

2. Clean off all road deposits from affected lower spherical joint seal and unscrew steel plug at bottom of joint housing.

3. Using Repacking Gun, J-9280, and Adapter, J-9280-5, apply lubricant, Part No. 105 0411 or equivalent, until grease is forced out between upper end of seal and knuckle, Fig. 3.16. Any water trapped in the joint should be forced out by the fresh lubricant. After removing repacking gun, allow some lubricant to escape through fitting to relieve seal pressure before installing plug.

CAUTION: Make certain that proper type lubricant is used when repacking suspension joints as use of other lubricant may not provide satisfactory lubrication.

4. Install service plug, tightening to 48 inch-pounds.

5. Inspect seal for cuts, chafes, or pin holes. Escape of lubricant from any place other than top of seal indicates a damaged seal that should be replaced.

6. Repeat steps 2 through 5 on opposite side of car.

7. Lower car.

10. Front Lower Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise car and place jack stands under lower suspension arms approximately 2 inches inboard of spherical joints.

CAUTION: Jack stands must be used to prevent lower arm from swinging down when locknut is removed from joint stud.

2. Remove wheel and tire assembly.

3. Remove locknut from lower spherical joint stud and install a standard nut on joint stud, running nut to

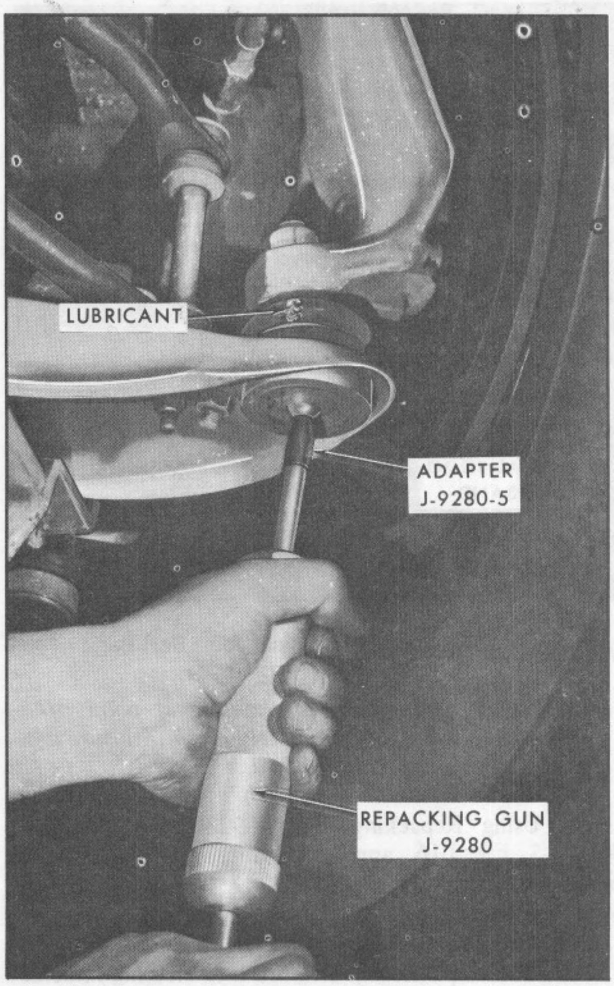


Fig. 3-16 Repacking Front Lower Spherical Joint Seal

within two threads of steering knuckle support. This nut will prevent lower arm from dropping down when joint stud is broken free of steering knuckle.

4. Raise front of car slightly off jack stands with hydraulic jack.

5. Strike steering knuckle with a heavy hammer in area of spherical joint stud to break stud loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

6. Lower car on jack stands, being certain that rebound bumper on upper arm clears frame, and remove standard nut from joint stud.

7. Lift hub and caliper and remove steering knuckle from lower joint stud.

8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.

9. Pry copper band off bottom of seal. Remove and discard seal and band.

10 Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.

11. Unscrew service plug from spherical joint.

12. Install a new seal on spherical joint using Seal Band Installer, J-22610, Fig. 3-17, to position band on seal as shown in Fig. 3-18.

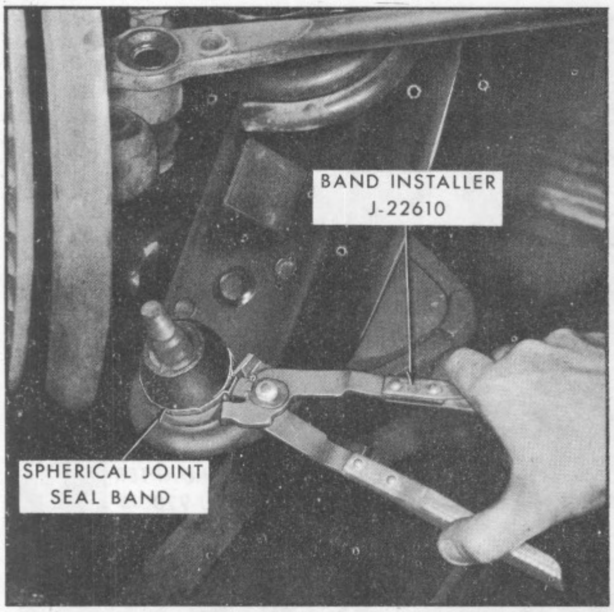


Fig. 3-17 Installing Spherical Joint Seal Band

CAUTION: Spherical joint housing at point of seal contact must be completely clean to insure a good seal when band is installed.

13. Using Repacking Gun, J-9280, and Adapter, J-9280-5, Fig. 3-16, apply lubricant, Part No. 1050411 or equivalent, until approximately two teaspoons of lubricant escapes from the joint.

14. Install service plug, tightening to 48 inch-pounds.

15. Guide spherical joint stud into steering knuckle support.

16. Install standard nut and an ordinary flat washer on joint stud and tighten nut until joint stud seats in steering knuckle support.

17. Remove standard nut and washer and install locknut on joint stud, tightening to 85 foot-pounds.

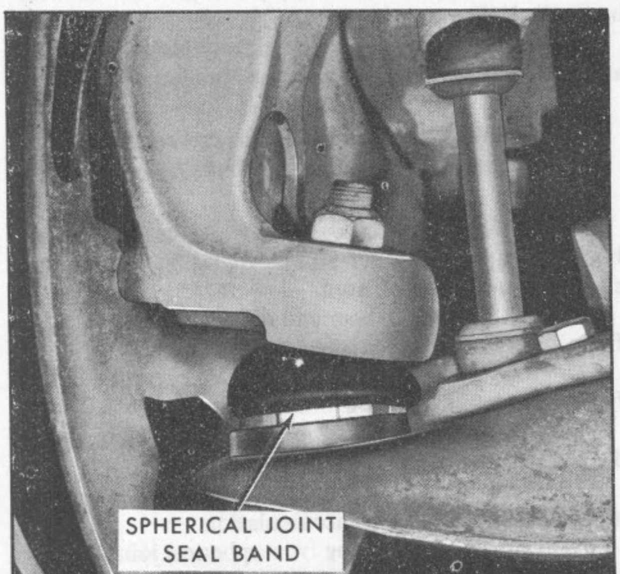


Fig. 3-18 Spherical Joint Seal Band Position

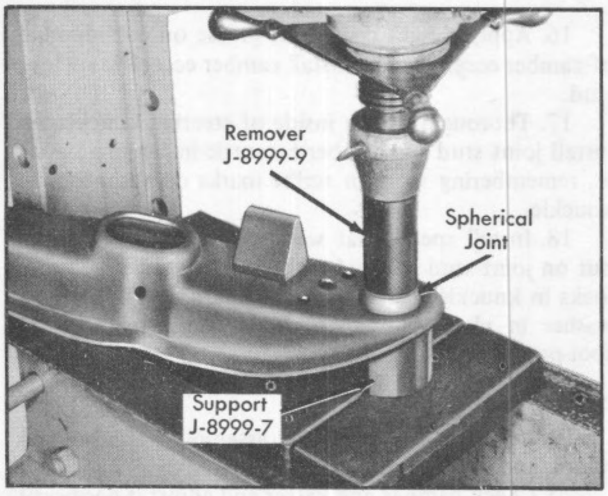


Fig. 3-19 Removing Spherical Joiint From Lower Arm

CAUTION: See Page 3-6.

(NOTE: A large quantity of grease will purge from upper end of joint because seal volume is reduced when installed in steering knuckle. Remove excess grease.)

18. Install wheel and tire assembly, tightening wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

19. Replace wheel disc, remove jack stands, and lower car.

11. Front Lower Suspension Arm Spherical Joint

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 15a.
2. Remove band and seal from spherical joint.
3. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on Support with spherical joint cover resting in Support.
4. Position Spherical Joint Remover, J-8999-9, over joint stud until it seats on joint housing, Fig. 3-19, and press spherical joint out of arm.

b. Installation

1. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on support, bottom side up, so that spherical joint mounting hole is encompassed by support.
2. Insert new spherical joint in arm, stud end first, aligning joint housing with mounting hole.
3. Position Spherical Joint Installer, J-8999-5, on flanged portion of joint housing, Fig. 3-20, and press spherical joint into arm until joint flange bottoms on mounting hole flange.
4. Install lower suspension arm and coil spring as described in Note 15b.

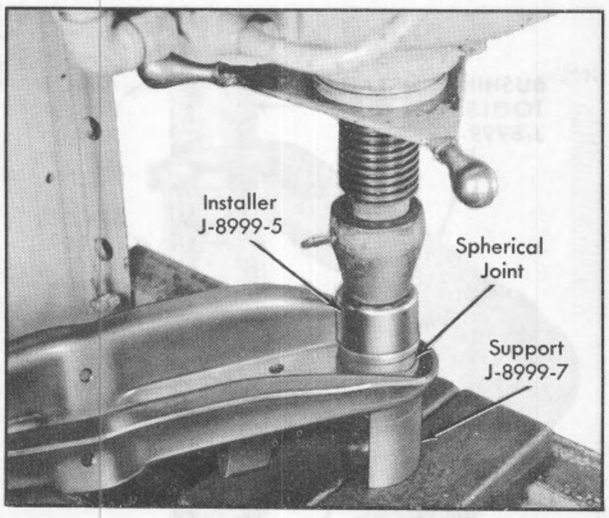


Fig. 3-20 Installing Spherical Joint In Lower Arm

12. Front Upper Suspension Arm

a. Removal

1. Raise front of car and remove wheel and tire assembly.
2. Remove locknut from upper spherical joint stud and install a standard nut on end of joint stud to within 2 threads of tight to knuckle.
3. Using a hammer, strike steering knuckle in area of upper spherical joint stud until joint is free from steering knuckle. Support on jack stands located under lower suspension arms as close to spherical joints as possible. Then remove nut from stud, Fig. *Page 3-6.*

CAUTION: Use extreme care to prevent hammer from slipping and damaging either the brake hose or the spherical joint seal.

4. Remove nuts, washers, and shaft mounting bolts at frame tower, Fig. 3-21. Remove upper suspension arm and shaft assembly. If right upper control arm is being removed, remove rear bushing heat shield.
5. Remove nut and flat washer from each end of shaft.
6. Camber eccentric may be removed from spherical joint stud if necessary, by using Puller, J-24319.

CAUTION: Do not attempt to remove spherical joint from upper suspension arm. Since it is welded to arm, any rewelding could damage joint seal or weaken arm. The upper arm and spherical joint are serviced as an assembly.

b. Installation

1. Position upper arm assembly on frame tower. If right upper control arm is being installed, position heat shield over rear bushing and install mounting bolts, washers, and locknuts, Fig. 3-21. Tighten bolts to 85 foot-pounds.

CAUTION: See Page 3-6.

2. Install camber eccentric on joint stud if previously removed.

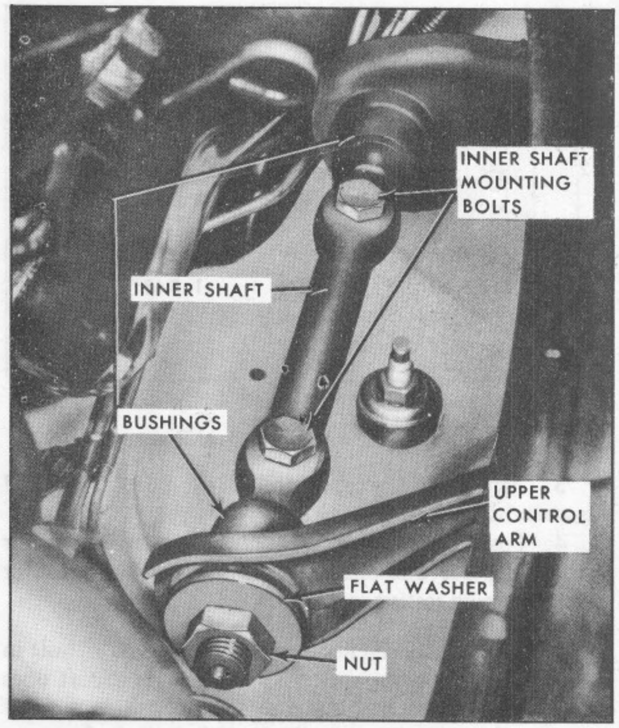


Fig. 3-21 Upper Control Arm Shaft And Bushings Installed

3. Guide joint stud and camber eccentric into upper end of knuckle and install standard nut and special flat washer on end of joint stud.
4. Tighten nut until camber eccentric seats in knuckle; then remove standard nut and, holding flat washer in place, install locknut. Tighten to 60 foot-pounds.

CAUTION: See Page Page 3-6.

5. Install wheel, remove jack stands, and lower car. Then tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page Page 3-6.

6. Install flat washer and shaft attaching nut on each end of shaft. Tighten nuts to 85 foot-pounds.

CAUTION: See Page Page 3-6.

7. Check wheel alignment and adjust if necessary.

13. Front Upper Suspension Arm Shaft and Bushings

It will be necessary to make two spacers from cold rolled steel or similar material to facilitate removal of bushings from shaft. Dimensions of the spacers are shown in Fig. 3-22. Also provide two 1/2 inch x 2 inch bolts with nuts to hold spacers in position around shaft.

a. Removal

1. Remove upper suspension arm assembly, following procedure of Note 12a.
2. Install spacers on shaft between arm ends. Secure spacers to shaft with bolts and nuts, Fig. 3-23.

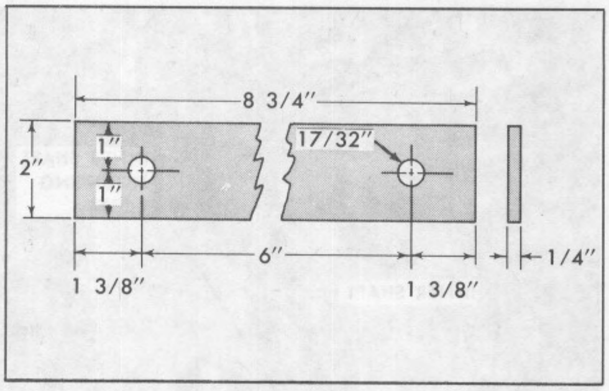


Fig. 3-22 Bushing Remover Spacer

3. Apply a liberal amount of penetrating oil between bushing sleeve and arm.

4. Position Support, J-8999-2, on anvil of arbor press and place one end of arm on support with outer end of bushing resting in support.

(NOTE: It will be necessary to drill a 1-1/4" hole in center of base of Support, J-8999-2, so that shaft does not bottom before bushing is removed. Position anvil of press so that slot in anvil aligns with hole in Support, J-8999-2.)

5. Insert Spacer, J-8999-1, to prevent control arm from bending when bushings are pressed out.

6. Press shaft downward until spacer plates touch extruded flanges of control arm, Fig. 3-23.

7. Remove arm assembly from arbor press, insert on opposite end, and repeat step 6.

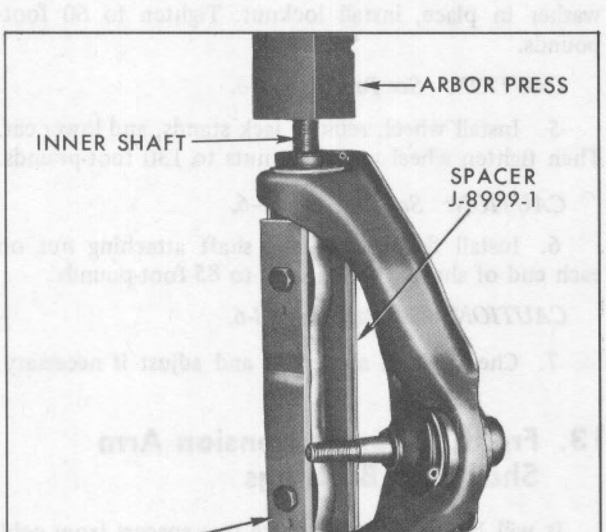


Fig. 3-23 Removing Bushing From Upper Arm

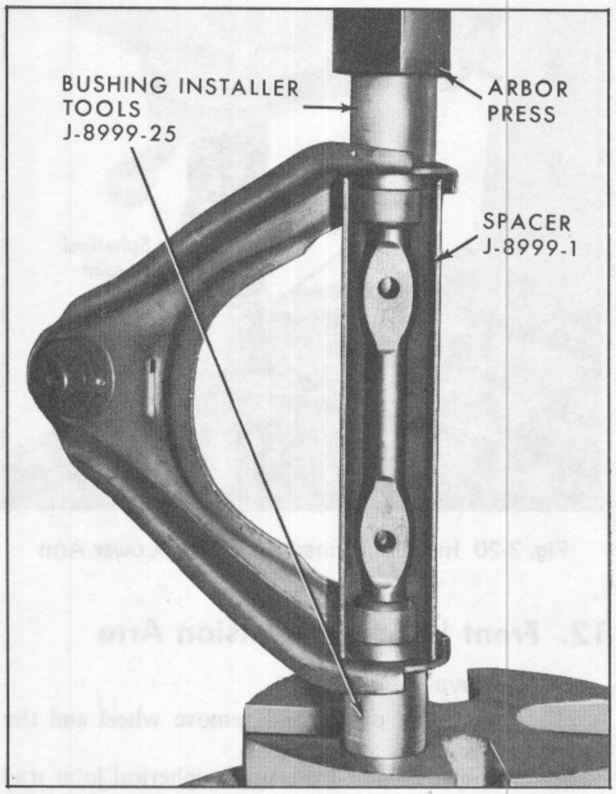


Fig. 3-24 Installing Shaft And Bushing In Upper Arm

8. Remove arm assembly from arbor press. If necessary, tap end of bushing with hammer to complete its removal.

9. Remove Spacer, J-8999-1, from assembly. Remove spacer bolts, nuts, and plates from shaft, and remove shaft.

b. Installation

1. Position one Bushing Installer, J-8999-25, on arbor press anvil.

2. Insert inner shaft in control arm and place bushing over end of shaft and into hole in control arm.

3. Place arm and bushing on bushing installer with outer end of bushing seated in installer, Fig. 3-24.

4. Rotate inner shaft until a 14° angle is achieved between shaft and control arm as shown in Fig. 3-25.

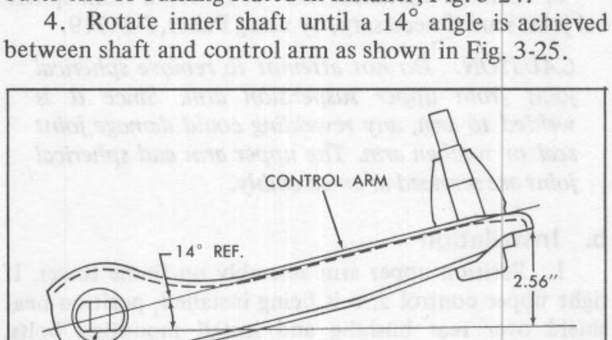


Fig. 3-25 Alignment Of Upper Control Arm And Inner Shaft

This angle can be found by inverting the arm and placing a 2 1/2 inch block of wood under the edge of the arm at the spherical joint end. Keep the lower flat of the shaft on the same surface as the wood block.

(NOTE: This angle is important in that it prevents bushing strain after installation and lengthens bushing life.)

5. Position bushing on opposite end of shaft, and place the other Bushing Installer, J-8999-25, on top of bushing. Hold assembly in place by exerting slight pressure on arbor press, Fig. 3-24.

6. Check alignment of bushings, arm ends, and shaft.

7. Install Spacer, J-8999-1, around shaft between arm ends to prevent arms from collapsing when bushings are installed.

8. Using arbor press, press bushings onto shaft until both bushing flanges bottom on arms.

(NOTE: It is possible that both bushing inner sleeves may not butt flush against shaft shoulder. However, when shaft attaching nuts are tightened, bushing inner sleeves will seat themselves.)

9. Remove arm assembly and installer tools from arbor press, and remove spacer tool.

10. Install flat washer and nut on each end of shaft.

(NOTE: Do not torque nuts at this time.)

11. Install upper suspension arm assembly as described in Note 12b.

15. Front Lower Suspension Arm and Coil Spring

(NOTE: To effectively control bumper heights, springs for all models are computer selected according to vehicle weights including all accessories. When replacing springs, be certain to select the proper spring as listed in the Cadillac Parts Manual.)

a. Removal

1. Disconnect front shock absorber at its upper mount.

2. Raise front of car and place jack stands under front frame side rails.

3. Remove wheel assembly.

4. Disconnect stabilizer link from lower arm that is to be removed.

5. Disconnect tie-strut at lower arm.

6. Remove bolt, nut, and washer securing shock absorber to lower arm and remove shock absorber from lower mount.

7. Remove nut from pivot bolt in lower arm at frame mount.

8. Position hydraulic jack under outboard end of lower suspension arm so that jack is supporting arm.

9.. Remove locknut from lower spherical joint stud. Install standard nut on joint stud and run nut to within two threads of knuckle.

(NOTE: Nut will prevent lower arm from dropping when joint stud is broken free of steering knuckle.)

10. Strike knuckle with a hammer in area of spherical joint stud to break joint loose. To facilitate removal of joint stud from knuckle, raise opposite rear corner of car to help compress spring.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

11. Use jack to lift spring load from nut and remove nut from joint stud.

12.. Slowly lower jack and remove spring.

13. Remove pivot bolt and washer from lower arm at frame mount and remove arm.

b. Installation

1. Position inboard end of lower arm in frame mount and install pivot bolt and washer. Do not install nut at this time.

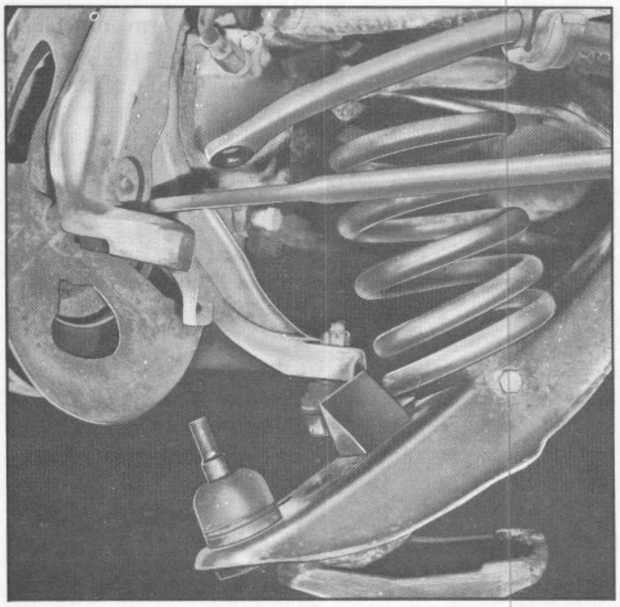


Fig. 3-27 Coil Spring Installation

(NOTE: Raised edge on top of arm faces front of car on right side and rear of car on left side.)

2. Install end of spring in upper seat of frame.

3. With aid of a helper and with jack placed under lower arm, Fig. 3-27, raise arm into position. Spring may have a tendency to rotate as arm is raised, mispositioning spring. Top of spring must seat within the five depressions on frame tower, and bottom end must be one half to one inch back of the front of left lower arm, or one half to one inch forward of the back of right lower arm, Fig. 3-28.

4. Guide spherical joint stud into steering knuckle.

5. Install standard nut and an ordinary flat washer on joint stud and tighten nut until joint stud seats in knuckle.

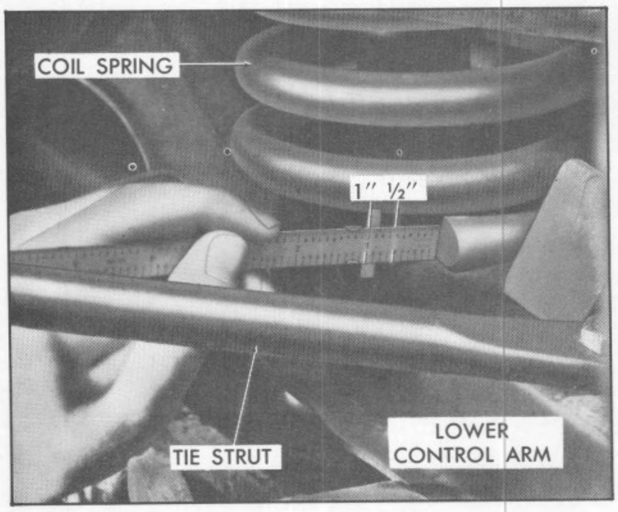


Fig. 3-28 Locating End Of Front Spring

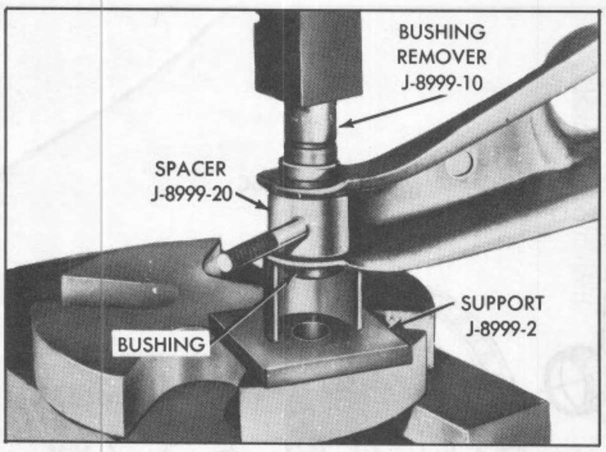


Fig. 3-29 Removing Bushing From Lower Arm

6. Remove standard nut and washer and install locknut on joint stud, tightening to 85 foot-pounds.

CAUTION: See Page 3-6.

7. Install nut on lower suspension arm pivot bolt. Do not tighten this nut until car is on all four wheels.

8. Insert shock absorber assembly up into coil spring and guide stem through tower in frame cross member. Place lower end in position on lower suspension arm. Install pivot bolt, lockwasher, and nut. Do not tighten nut until car is on all four wheels.

9. Install tie-strut on lower arm, securing with two bolts and nuts. Tighten nuts to 55 foot-pounds.

CAUTION: See Page Page 3-6.

10. Connect stabilizer link to lower arm.

11. Install wheel assembly.

12. Replace wheel disc and lower car.

13. Connect shock absorber at upper mount.

14. Tighten nut on lower suspension arm pivot bolt to 95 foot-pounds.

CAUTION: See Page 3-6.

15. Tighten nut at shock absorber lower mount in lower arm to 55 foot-pounds.

CAUTION: See Page 3-6.

16. Front Lower Suspension Arm Bushing

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 15a.

2. Use a stiff wire brush to clean the small outer diameter end of the bushing and the portion of the bushing between the legs of the arm.

(NOTE: This step will help prevent corrosion on the bushing outer sleeve from gouging grooves in the arm upon removal.)

3. Position Support, J-8999-2, on arbor press anvil and insert larger diameter end of bushing in Support.

4. To prevent lower arm from collapsing when bushing is pressed out, place Spacer, J-8999-20, around inner flange of lower control arm. Inner flange is located on larger diameter bushing side.

5. Position Bushing Remover, J-8999-10, on sleeve, Fig. 3-29, and press bushing out of arm.

6. Inspect bushing holes in front lower control arm for distortion of gouges in holes. If arm is damaged, it will be necessary to replace arm.

b. Installation

1. Position Support, J-8999-2, on arbor press anvil and insert smaller diameter flanged end of bushing mount in Support.

2. Install new bushing in arm, smaller diameter end of bushing first, until bushing pilots itself in opposite flanged end.

3. Place Spacer, J-8999-20, around inner flange of lower control arm and insert Spacer, J-8999-23, between bushing flange and control arm, Fig. 3-30.

4. Position Bushing Installer, J-22222-2, over end of bushing and press bushing into arm until bushing flange bottoms on Spacer, J-8999-23.

5. Remove arm assembly and all tools from press.

6. Install lower suspension arm and coil spring as described in Note 15b.

17. Steering Knuckle

a. Removal

1. Remove wheel disc and loosen wheel mounting nuts on side from which steering knuckle is to be removed.

2. Raise front end of car and place jack stands under front frame side rails.

3. Remove wheel mounting nuts and remove wheel and tire.

4. Remove two bolts securing brake caliper to steering knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm shaft.

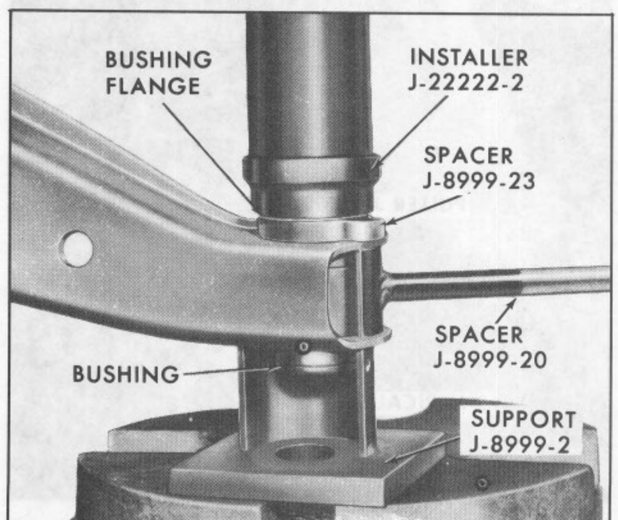


Fig. 3-30 Installing Bushing In Lower Arm

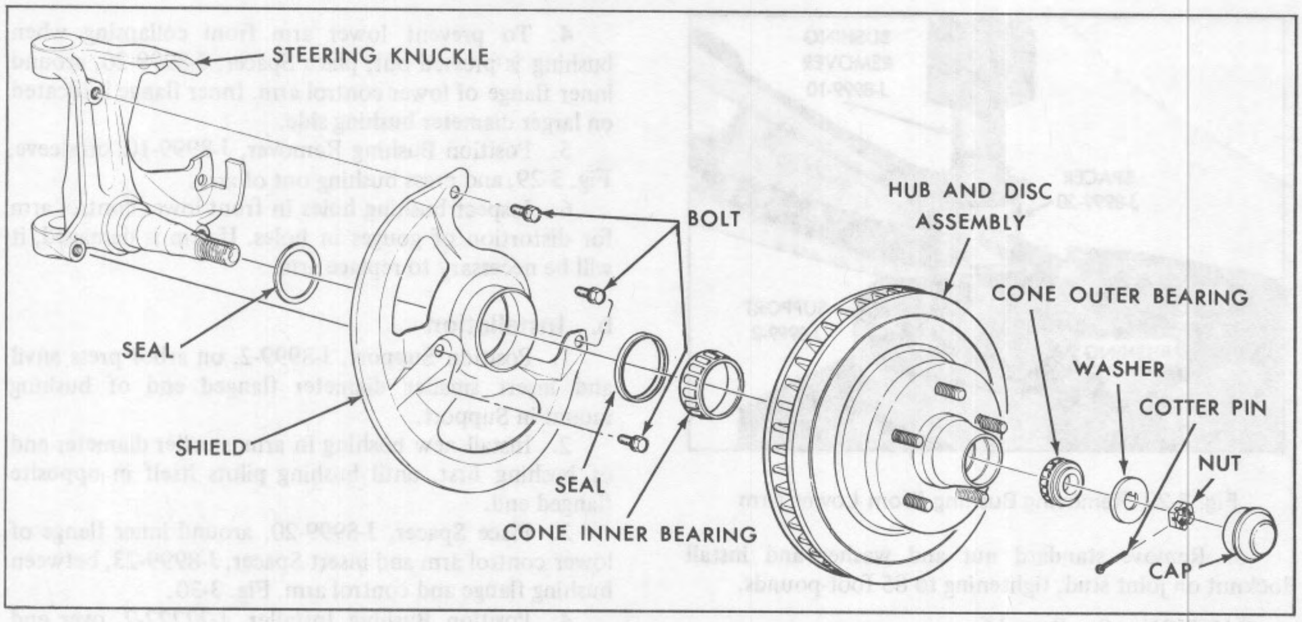


Fig.3-31 Front Wheel Disassembled

CAUTION: Never allow caliper to hang from brake hose, as the brake hose may be damaged.

5. Remove dust cap, cotter pin, spindle nut, and washer.

6. Remove outer cone and bearing assembly.

7. Remove hub and disc assembly from steering knuckle spindle, Fig. 3-31.

8. Remove three screws securing splash shield to steering knuckle, and remove splash shield and seal.

9. Remove cotter pin and nut from tie-rod end stud.

10. Using Puller, J-24319 remove tie-rod joint from steering knuckle, Fig. 3-32.

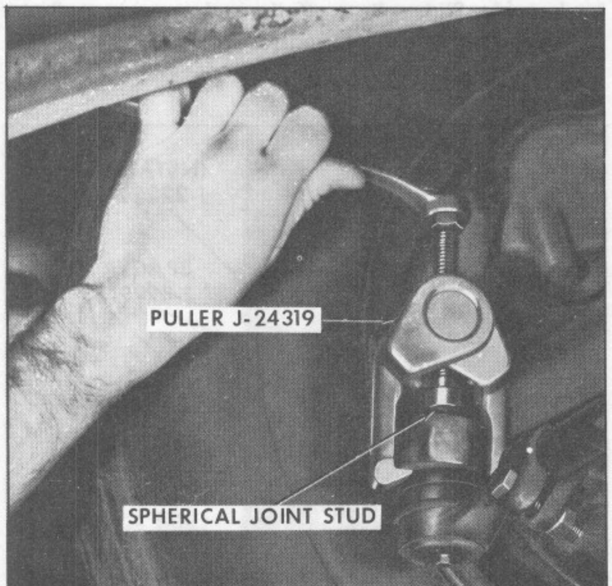


Fig. 3-32 Removing Tie Rod Joint Stud From Steering Knuckle

11. Remove locknut from lower joint stud. Install standard nut on joint stud and run to within two threads of knuckle. Using a hammer, strike knuckle in area of joint stud to break joint loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

12. Remove locknut from upper spherical joint stud and, leaving special flat washer in place, install standard nut on joint stud and run nut to within two threads of knuckle.

13. Using a hammer, strike knuckle in area of joint stud to break joint loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

14. Raise the car and move the jack stand from the frame side rail to the lower suspension arm as close under the spherical joint as possible on side from which steering knuckle is to be removed.

15. Remove standard nuts and flat washer, raise up on upper arm, and remove joint stud from end of steering knuckle.

16. Lift steering knuckle off lower joint stud and remove knuckle from car.

b. Installation

1. Guide upper joint stud into steering knuckle upper support and install a standard nut and special flat washer on joint stud. Tighten nut to seat joint stud in knuckle.

2. Remove standard nut and, holding flat washer in place, install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

3. Guide lower spherical joint stud into steering knuckle lower support.

4. Install standard nut and an ordinary flat washer on joint stud and tighten until stud seats in knuckle,

then remove standard nut and washer and install lock-nut, tightening to 85 foot-pounds.

CAUTION: See Page 3-6.

5. Install tie-rod end on steering knuckle and install nut. Tighten nut to 37 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

6. Position seal and splash shield on steering knuckle. Install three screws securing splash shield to steering knuckle and tighten screws to 114 inch-pounds.
7. Install hub and disc assembly on spindle.
8. Install washer and spindle nut, tightening nut with fingers.
9. Install caliper following Steps 1 through 10 of Section 5, Note 12c. Pump brake pedal two or three times to insure a firm pedal.
10. Adjust wheel bearings as in Note 18a.
11. Install wheel and tire and install wheel mounting nuts finger tight.
12. Raise car, remove jack stands, and lower car.
13. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

14. Install wheel disc.
15. Check front wheel alignment and adjust as required, Note 2.

18. Wheel Bearings

Front wheels are equipped with a set of tapered roller bearings mounted in opposing directions to accommodate various combinations of vehicle loading, Fig. 3-31.

a. Front Wheel Bearing Adjustment

1. Raise front of car. Remove wheel disc, dust cap, and cotter pin. Make sure hub is fully seated on spindle.
2. While rotating wheel and tire assembly, tighten spindle nut to 15 foot-pounds to seat all bearing parts.
3. Back off spindle nut until free (approximately one flat) then retighten until nut is finger tight.

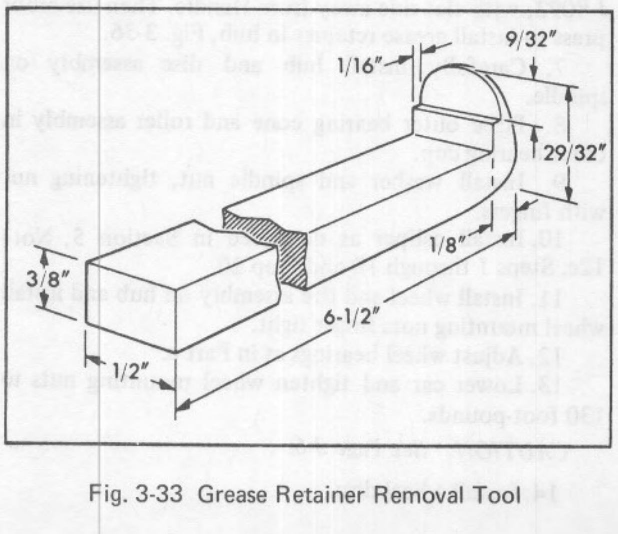


Fig. 3-33 Grease Retainer Removal Tool

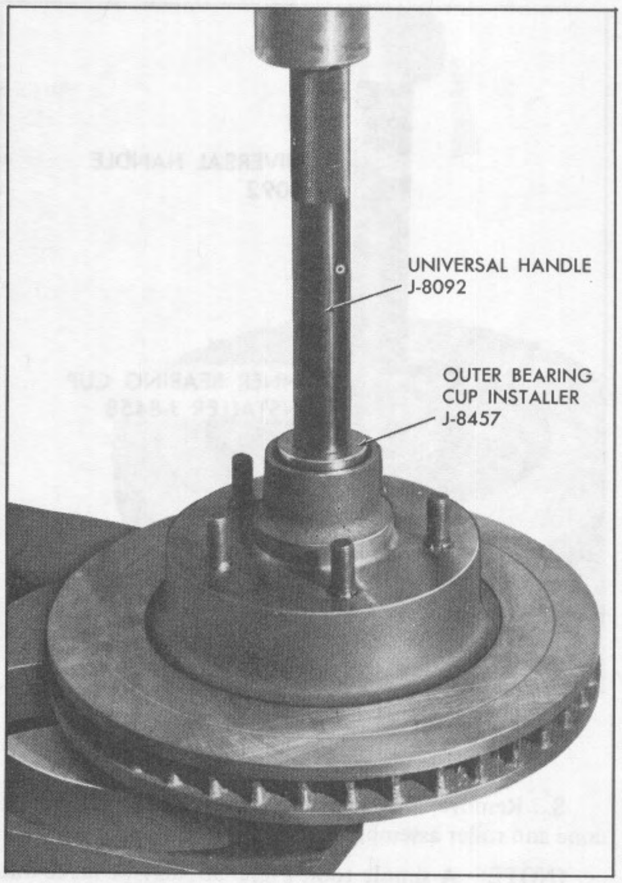


Fig. 3-34 Installing Outer Bearing Cup

4. Install new cotter pin. If pin cannot be installed at finger tight position, back off nut until holes line up and install pin.
5. Spread cotter pin and bend back around sides of nut. Install dust cap and make sure ends of cotter pin do not interfere with dust cap.

CAUTION: Cotter pin must be tight after installation. If pin can be moved with finger, remove pin and install another new cotter pin.

6. Install wheel disc and lower car.

b. Front Wheel Bearing Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise front end of car.
4. Remove wheel mounting nuts and remove wheel assembly from hub.
5. Remove two bolts securing caliper to knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm.

CAUTION: Never allow caliper to hang from brake hose, as the hose may be damaged.

6. Remove dust cap, cotter pin, spindle nut, washer, and outer cone and roller assembly, Fig. 3-31.
7. Remove hub and disc assembly from steering knuckle spindle. Take care to prevent damage to spindle threads or grease seal.

Fig. 3-35 Installing Inner Bearing Cup

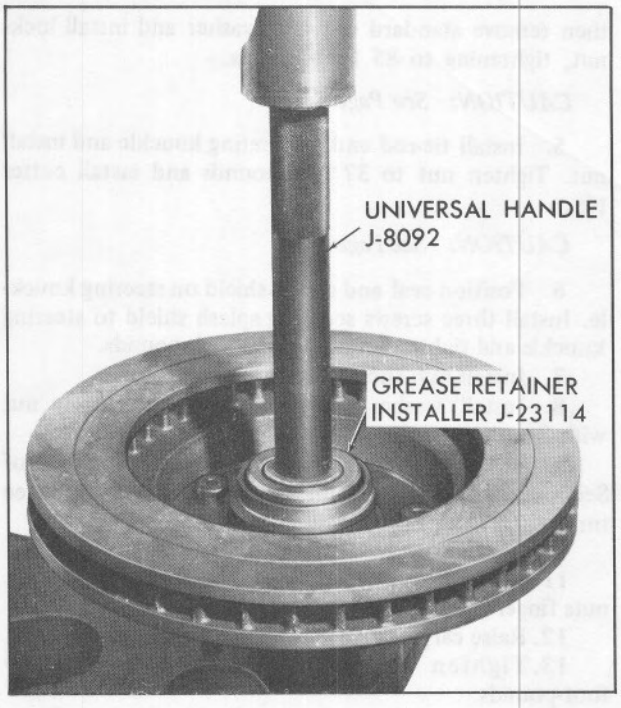


Fig. 3-36 Installing Grease Retainer

8. Remove inner bearing grease seal, and bearing cone and roller assembly.

(NOTE: A simple tool, Fig. 3-33, may be made out of cold rolled steel or from an old screwdriver to facilitate removal of the grease seal. Use of this tool will prevent possible damage to inner bearing assembly and hub surface when removing seal.)

9. Inner and outer bearing cups are press fit in hub, and can be removed by driving out from opposite side with a long brass drift. Tap alternately on opposite sides of cup to avoid cocking cup and damaging inside of hub.

(NOTE: Discolored stripes on bearing cups, particularly on low mileage cars, do not necessarily indicate a rough bearing race. If stains can be removed by light polishing, replacement is not required. See Fig. 4-43.)

c. Cleaning and Inspection

1. Clean bearing cone assemblies and cups thoroughly with clean solvent. Replace complete assembly if any parts are worn, pitted, or rough.

2. Inspect bearing cups and hub surfaces carefully for nicks or small particles of foreign material. All seating surfaces must be absolutely smooth.

3. If bearing cup O.D. is scored, or if bearing cup separated very easily from housing, a loose housing fit is indicated. Examine hub bearing surfaces to assure proper bearing cup seating and fit. Replace hub and disc assembly if necessary.

4. Examine spindle bearing seats for excess wear or damage that could prevent proper slip fit seating of cone assemblies. Replace steering knuckle if necessary.

d. Installation

1. Lubricate spindle and hub bore with thin film of #2 grade lithium high melting point wheel bearing grease to prevent rust. Excess grease should be avoided to reduce possibility of leakage.

2. Install outer bearing cup, using Front Hub Outer Bearing Cup Installer, J-8457, and Handle, J-8092. Use arbor press to install bearing cup in hub, Fig. 3-34.

3. Install inner bearing cup, using Front Hub Inner Bearing Cup Installer, J-8458, and Handle, J-8092. Use arbor press to install bearing cup in hub, Fig. 3-35.

4. Pack bearing cone and roller assemblies with #2 grade lithium high melting point wheel bearing grease. Use a commerical bearing packer or pack bearings by hand. Force grease in at large end of roller cage until grease protrudes from small end.

5. Place inner bearing cone and roller assembly in inner bearing cup.

6. Install new grease seal using a flat plate until seal is flush with hub. One way to perform this step is to screw Seal Installer, J-23114, into Universal Handle, J-8092, with flat side away from Handle. Then use arbor press to install grease retainer in hub, Fig. 3-36.

7. Carefully install hub and disc assembly on spindle.

8. Place outer bearing cone and roller assembly in outer bearing cup.

9. Install washer and spindle nut, tightening nut with fingers.

10. Install caliper as described in Section 5, Note 12c, Steps 1 through 10 and Step 20.

11. Install wheel and tire assembly on hub and install wheel mounting nuts finger tight.

12. Adjust wheel bearings as in Part a.

13. Lower car and tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

14. Install wheel disc.

TORQUE SPECIFICATIONS (EXCEPT ELDORADO)

Material No.	Application	Tread Size	Foot-Pounds
301-M	Spherical joint to knuckle (lower)	9/16-18	85*
301-M	Spherical joint to knuckle (upper)	1/2-20	60*
GM6010-M	Stabilizer bracket to frame attaching screws	3/8-16	35
301-M	Suspension arm shaft to frame nuts (upper)	1/2-20	85*
286-M	Suspension arm shaft attaching nuts (at bushings) 1-1/4"	3/4-16	85*
301-M	Suspension arm to frame (lower)	9/16-12	95*
301-M	Front shock absorber to lower arm nut	7/16-14	55
286-M	Tie rod adjuster clamp nuts	3/8-24	22
301-M	Tie rod pivots to steering knuckle	1/2-20	37*
301-M	Tie-strut to lower arm	7/16-20	55*
284-M	Tie-strut to frame at front bushing	3/4-16	50*
286-M	Wheel mounting nuts	1/2-20	130*
			Inch-Pounds
SAE 1110-1112	Front shock absorber upper stem nut	3/8-24	180
SAE 12L14	Spherical joint service plug	1/4-28	48
SAE 1110	Front stabilizer link nut	5/16-24	150
284-M	Front stabilizer link locknut	5/16-24	150
275-M	Splash shield to steering knuckle screws	1/4-20	114

*****CAUTION: *These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

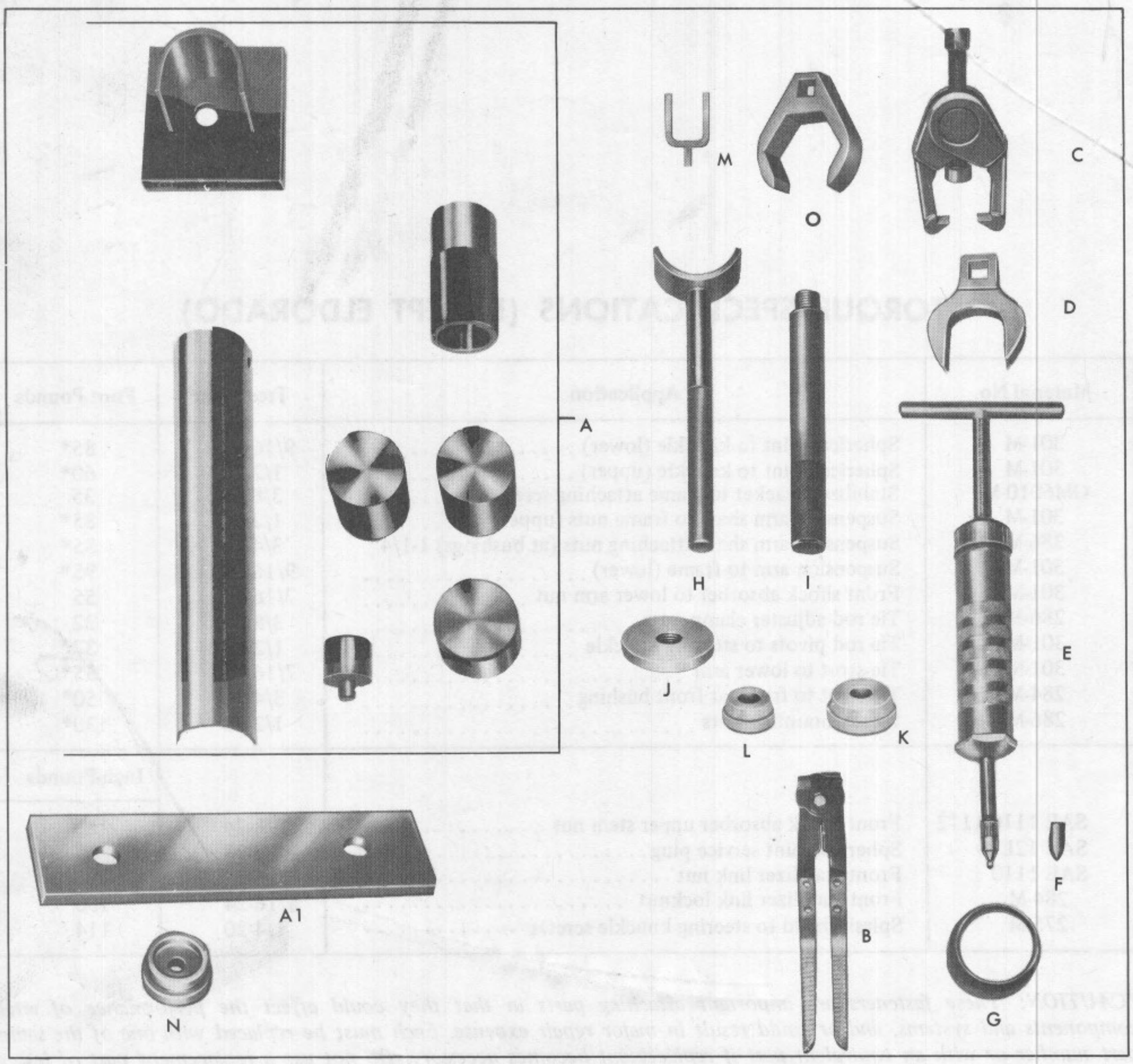


Fig. 3-37 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8999	Front Suspension Service Set	H	J-8999-20	Spacer
A1	None	Bushing Remover Spacer (2)	I	J-8092	Universal Handle
B	J-22610	Band Installer	J	J-23114	Front Hub Grease Retainer Installer
C	J-24319	Puller Front Suspension	K	J-8458	Front Hub Inner Bearing Cup Installer
D	J-23415	Camber Adjustment Wrench	L	J-8457	Front Hub Outer Bearing Cup Installer
E	J-9280	Repacking Gun (Spherical Joints)	M	J-8999-23	Spacer
F	J-9280-5	Repacking Gun Adapter	N	J-22222-2	Bushing Installer
G	J-9148	Garter Spring Installer	O	J-24515	Caster Adjusting Wrench

GENERAL DESCRIPTION

The service information that follows pertains only to the Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

The front suspension on the Eldorado consists of two upper and two lower control arms, a stabilizer bar, shock absorbers, and a right and left torsion bar, Fig. 3-39. Torsion bars are used instead of coil springs. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into an adjustable arm in the torsion bar cross member. The standing height of the car is controlled by the adjuster bolt and nut that positions the adjuster arm.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition, and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, torsion bars, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

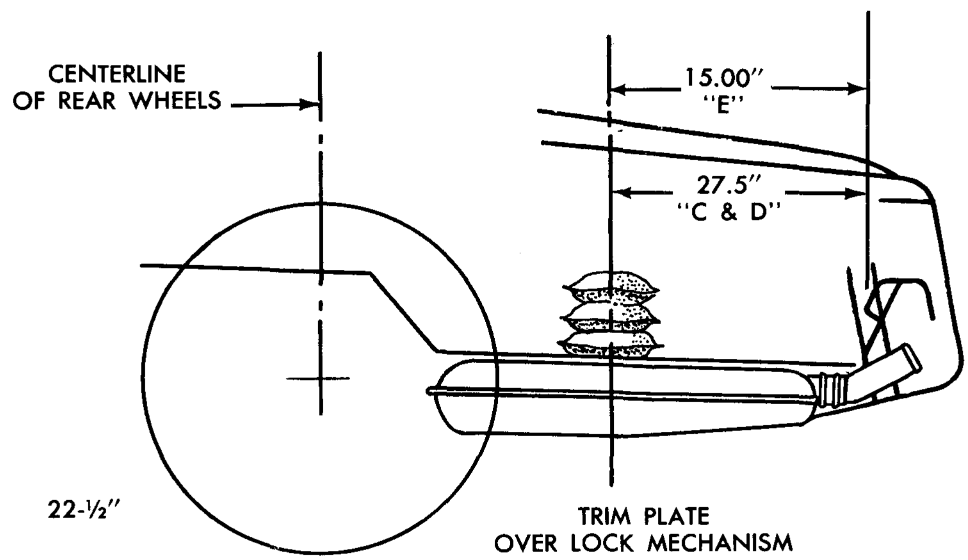
SERVICE INFORMATION

19. Standing Height Adjustment (Eldorado)

The standing height must be checked, and adjusted if necessary, before performing the front end alignment procedure. The standing height is controlled by the adjustment setting of the torsion bar adjusting bolt.

Clockwise rotation of the bolt increases the front height; counterclockwise decreases the front height.

Car must be on a level surface, gas tank full (or a compensating weight added as shown in Fig. 3-38), front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure



	FUEL GAGE READING	AMOUNT OF WEIGHT (BAGS OF SHOT OR EQUIVALENT)
ALL SERIES	FULL	0
	¾	40 LBS.
	½	75 LBS.
	¼	110 LBS.
	ALMOST EMPTY	150 LBS.

Fig. 3-38 Compensating Weights

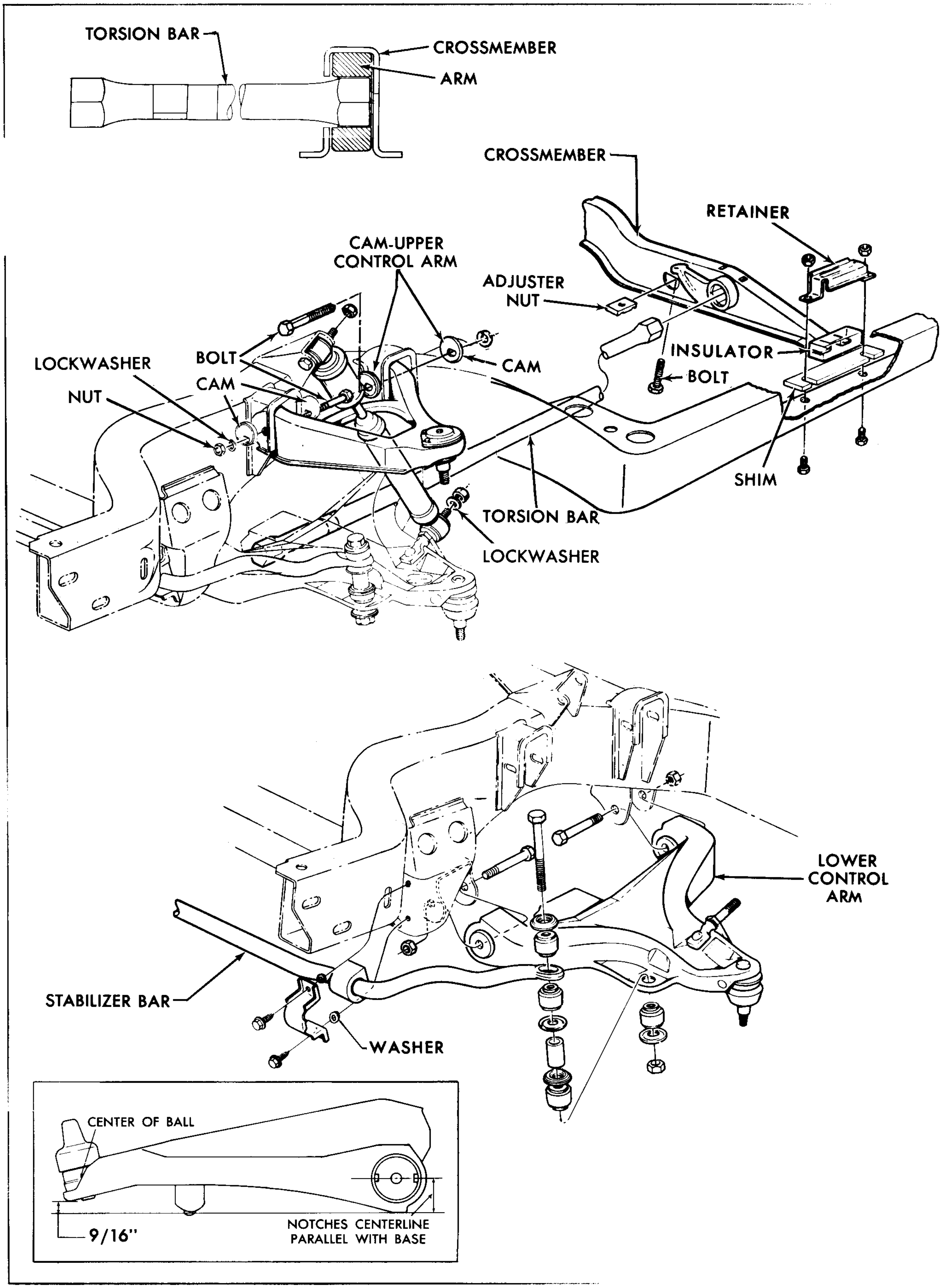


Fig. 3-39 Front Suspension Eldorado-Disassembled

Chart, Fig. 10-1. Both doors must be closed and no passengers or additional weight should be in car or trunk.

It is recommended that a wheel alignment pit be used for checking standing heights rather than channel type hoists due to the possibility of hoist deflection under vehicle weight, which distorts the standing height measurements.

To measure standing heights check the frame to axle clearance (rear) and lower edge of front shock absorber dust tube to centerline of lower attachment (front).

Standing height specifications for the Eldorado are including in Fig. 3-2.

(NOTE: Before checking rear standing height, loosen air line connection to shock absorbers to remove all air from shock absorbers. Also, be sure to bounce front of car several times, gradually reducing bouncing effort, to normalize standing height.)

After standing height is adjusted, check and adjust front wheel alignment as described in Note 20.

20. Front Wheel Alignment (Eldorado)

Satisfactory vehicle operation may occur over a wide range of front end (wheel) alignment settings. Nevertheless, should settings vary beyond certain tolerances, readjustment of alignment is advisable. The specifications stated in column 2 of the specifications chart should be used by owners, dealers, and repairmen as guidelines in vehicle diagnosis either for repairs under the new warranty or for maintenance service at customer's request. These specifications provide an acceptable all-around operating range in that they prevent abnormal tire wear caused by wheel alignment.

Governmental Periodic Motor Vehicle Inspection programs usually include wheel alignment among items that are inspected. To provide useful information for such inspections, the specifications stated in column 3 of the specification chart are given and these are well within the range of safe vehicle operation.

ELDORADO WHEEL ALIGNMENT SPECIFICATIONS*

	SPECIFICATIONS FOR RESETTING ALIGNMENT	TOLERANCE FOR DIAGNOSIS FOR WARRANTY REPAIRS OR CUSTOMER PAID SERVICE	TOLERANCE FOR PERIODIC MOTOR VEHICLE INSPECTION
Camber	LH $0^\circ \pm 3/8^\circ$ RH $-1/4^\circ \pm 3/8^\circ$	$\pm 3/4^\circ$	$\pm 1\ 1/2^\circ$
Cross Camber (LH Minus RH)	$1/4^\circ \pm 1/2^\circ$	$\pm 1^\circ$**	
Caster	$0^\circ \pm 1/2^\circ$	$\pm 1^\circ$	$\pm 2^\circ$
Cross Caster (LH Minus RH)	$0^\circ \pm 1/2^\circ$	$\pm 1^\circ$**	–
Toe-In	0" $\pm$ 1/16"	$\pm$ 1/8"	$\pm$ 3/8"

*Vehicle must have full lubricant, coolant and fuel levels with no passengers or luggage.

** Cross camber and cross caster not to exceed 1° maximum per vehicle.

Fig. 3-40 Eldorado Wheel Alignment Specifications

In the event the actual settings are beyond the specifications set forth in column 2 or 3 (whichever is applicable), or whenever for other reasons the alignment is being reset, Cadillac recommends that the specifications given in column 1 of the specification chart be used.

a. Sequence of Operation

(Front wheel alignment must be checked whenever the vehicle standing height is changed.)

Front wheel alignment must be performed in the exact sequence as described in this procedure. Wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment equipment. These instructions should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

(NOTE: Car must be on a level surface, gas tank full or a compensating weight added as shown in Fig. 3-38 front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure Chart, Fig. 10-1, Section 10. Both doors must be closed and no passengers or additional weight should be in car or trunk.)

1. Drive car to determine whether steering wheel is properly centered. If correction is needed, mark the straight ahead position with tape so that the change required can be made during the toe-in adjustment.
2. Check the front standing height and adjust, if necessary. Refer to Note 19.
3. Check front wheel alignment and adjust as required following procedure recommended by manufacturer of alignment equipment.
4. After removing vehicle from alignment machine, check the straight ahead position of the steering wheel to determine if it is properly centered. If further correction is required, repeat the toe-in portion of the wheel alignment procedure so that the necessary changes can be made.

b. Camber and Caster (Fig. 3-41)

(These adjustments can be made either from under car or under hood, as desired. If under hood approach is used, however, be sure to recheck alignment after all operations are completed. Change in weight distribution caused by opened hood is sufficient to disturb final alignment settings.)

1. Loosen nuts on upper control arm front and rear cam bolts.
2. Note camber reading and rotate front bolt to correct for 1/2 of incorrect reading or as near as possible.
3. Rotate rear cam bolt to bring camber reading to 0°.

CAUTION: Do not use a socket to adjust rear cam bolt on left side as brake pipes could be damaged. An offset box end wrench is recommended at this adjustment point.

4. Tighten front and rear bolts and check caster.

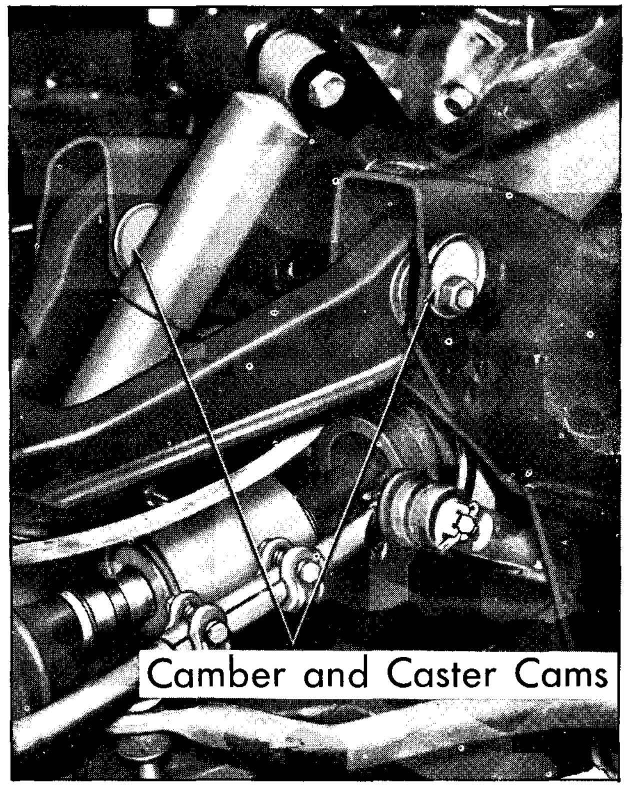


Fig. 3-41 Caster And Camber Cam Locations

(NOTE: If caster requires adjustment, proceed with step 5; if not, move to step 8.)

5. Loosen front and rear cam bolt nuts.
6. Using camber scale on alignment equipment, rotate front bolt so that the camber changes an amount equal to 1/4 of the desired caster change. (A caster change-to-camber change ratio of about 2 to 1 is inherent to the Eldorado suspension system. That is, when one cam is rotated sufficiently to change camber 1°, caster reading will change about 2°.)

(NOTE: If adjusting to correct for excessive negative caster, rotate front bolt to increase positive camber. If adjusting to correct for excessive positive caster, rotate front bolt to increase negative camber.)

7. Rotate the rear bolt until camber setting returns to its corrected position (Step 3).
8. Tighten upper control arm cam nuts to 95 foot-pounds. Hold head of bolt securely; any movement of the cam will affect final setting and will require a recheck of the camber and caster adjustments.

CAUTION: See Note 3-6.

c. Toe-In

Before checking toe-in, make certain that the drag link height is correct. See Section 9, Note 37 for drag link height.

Toe-in is adjusted by turning the tie-rod adjuster tubes at the outer ends of each tie rod after loosening clamp bolts. The readings should be taken only when the front wheels are in a straight ahead position so that the steering gear is on its high spot.

1. Center steering wheel, raise car, and check wheel run-out as described in Section 10, Note 15c.
2. Loosen tie-rod adjuster nuts and adjust tie-rods to obtain proper toe-in setting.
3. Position tie-rod adjuster clamps so that openings of clamps are facing up. Interference with front suspension components could occur while turning if clamps are facing down.
4. Tighten tie-rod adjuster nuts to 22 foot-pounds.

21. Front Shock Absorber

a. Removal

(NOTE: Perform work on platform type hoist or garage floor so that vehicle weight is on the front suspension.)

1. Disconnect shock absorber at upper and lower mount.
2. Compress shock absorber and work lower mount free from mount bolt using a screwdriver placed inside the mount inner sleeve for leverage.
3. Guide shock absorber down and toward rear of car, and remove from car.

b. Installation

1. Guide shock absorber up through upper control arm.
2. Position shock absorber on lower attaching stud, using screwdriver inside mount inner sleeve to facilitate bushing installation.
3. Extend upper shock absorber mount into frame attaching bracket using body weight on fender to compress suspension to assist in lining up mounting holes.
4. Install shock absorber upper attaching bolt and nut. Tighten nut to 75 foot-pounds.
5. Install lockwasher and lower attaching nut and tighten to 75 foot-pounds.

22. Stabilizer Bar

a. Removal

1. Place car on jack stands.
2. Remove link bolts, nuts, grommets, spacers, and retainers from lower control arm. Discard bolts and nuts.
3. Remove bracket to frame attaching bolts and remove stabilizer bar from car.

b. Installation

1. Position stabilizer bar in place on car.

(NOTE: Stabilizer bar grommets and retainers are larger than those used on previous models. Replacement parts must be of this larger design.

2. Assemble grommets, spacers, and retainers on new link bolt as shown in Fig. 3-42.
3. Position link bolt on lower control arm, and install remaining grommet, retainer, and nut.
4. Install stabilizer to frame brackets.
5. Tighten stabilizer link nuts to 156 inch-pounds.
6. Cut off or file link bolt threads flush with head of nut.

CAUTION: Failure to cut off excess bolt threads could result in front tire damage under extreme operating conditions.

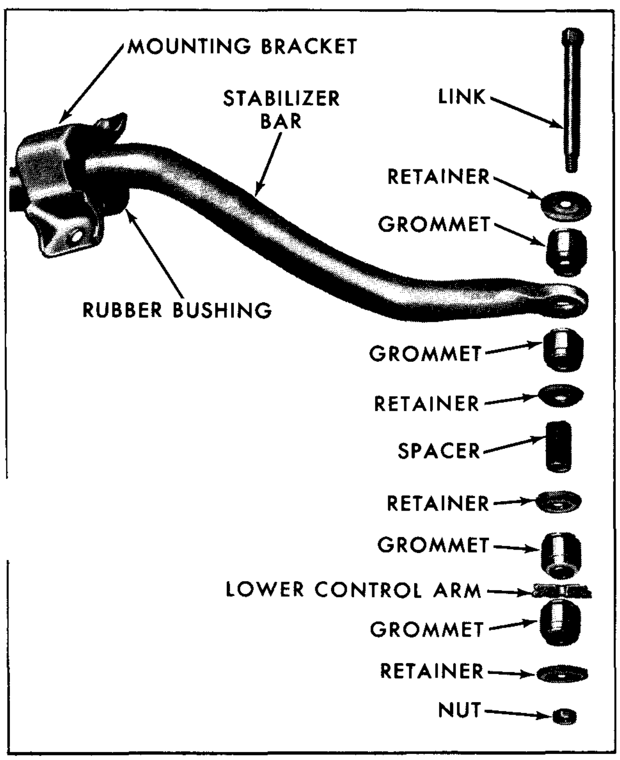


Fig. 3-42 Front Stabilizer Linkage (Eldorado)

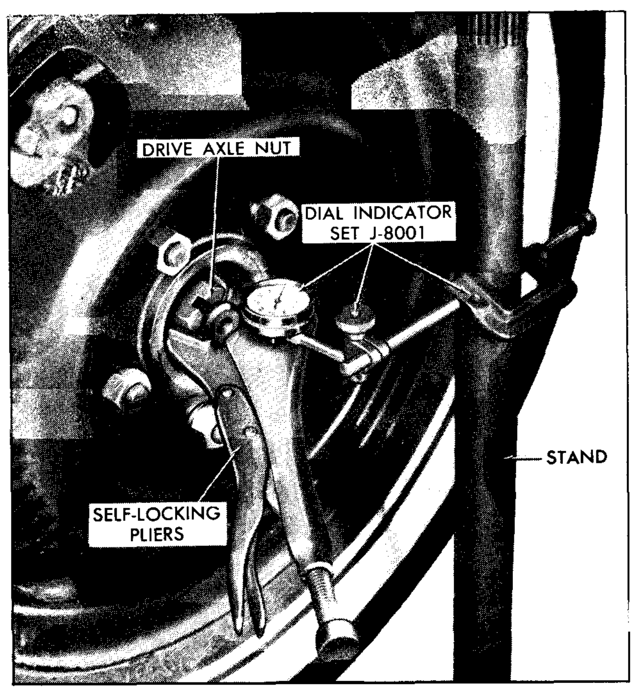


Fig. 3-43 Checking Spherical Joint End Play (Eldorado)

23. Spherical Joint Checking Procedure

1. Raise car and position jack stands under lower control arms as near as possible to each spherical joint. Car must be stable and should not rock on floor stands.
2. Clamp self-locking pliers on hub to drive axle nut so that self-locking pliers are in horizontal position, Fig. 3-43.
3. Construct a sturdy stand and install Dial Indicator, J-8001, so that indicator is horizontal and button contacts pliers, Fig. 3-43. Set dial to 0.
4. Place a pry bar between lower control arm and drive axle outer race as shown in Fig. 3-44, and pry down on bar. If reading exceeds .125" replace lower spherical joint, Note 32. (Very little prying effort is necessary to make this check. Often, weight of pry bar itself is all that is required.)

CAUTION: When positioning pry bar, use extreme caution to avoid contact with drive axle seal, as seal may become damaged internally.

24. Upper Control Arm Bushing (On Car)

a. Removal

The upper control arm bushings can be removed and installed on or off the car.

(NOTE: If car was originally equipped with radial tires, lower rate upper control arm bushings are used. These bushings are colored white and must be replaced, if necessary, with the same type bushings.)

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise car and remove wheel and tire.
4. Disconnect shock absorber at upper mount and remove nut and bolt.
5. Remove upper control arm cam assemblies and nuts.
6. Remove upper control arm from frame mounts.
7. Attach bushing removal tools as shown in Fig. 3-45.

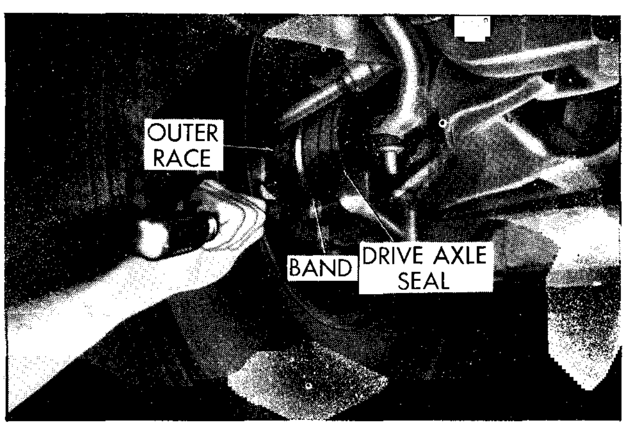


Fig. 3-44 Prying At Drive Axle Outer Race

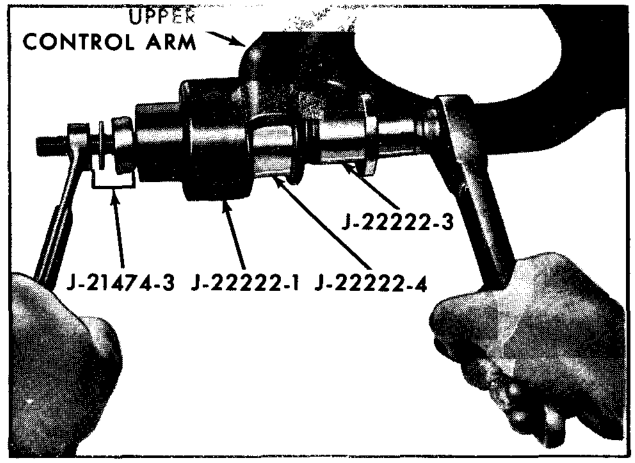


Fig. 3-45 Removing Front Upper Control Arm Bushings

(NOTE: Spray bushings with silicone lubricant to facilitate removal.)

8. Remove bushings and remove tools.

b. Installation

(NOTE: Spray bushings with silicone lubricant to facilitate installation.)

1. Place bushings in control arm.
2. Install tools as shown in Fig. 3-46 and press bushings into control arm.
3. Remove bushing installation tools.
4. Guide upper control arm over shock absorber and install bushing ends into frame mounts.
5. Install cam assemblies as shown in Fig. 3-41. Both front and rear cams should be mounted with bolt hole downward.
6. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.
7. Install wheel and tire.
8. Lower car and tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

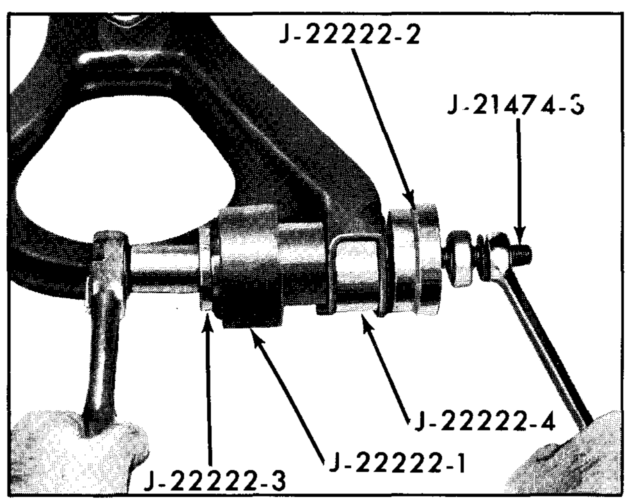


Fig. 3-46 Installing Front Upper Control Arm Bushings

9. Check standing height as described in Note 19 and adjust if necessary.

10. Adjust toe-in, caster, and camber as described in Note 20.

11. Install wheel disc.

25. Upper Control Arm

a. Removal

The upper control arm can be serviced either as an assembly, or by its component parts. If it is not necessary to replace the control arm as an assembly, there are two service packages available. One package contains bushings only, the other package consists of a spherical joint, two bolts, one nut, and a cotter pin.

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise car. Support on jack stands located under lower suspension arms as close to spherical joints as possible.
4. Remove wheel mounting nuts and remove wheel and tire.
5. Disconnect shock absorber at upper mount.
6. Remove cotter pin and nut on upper spherical joint.
7. Remove brake hose clip from spherical joint stud.
8. Remove two bolts securing brake caliper to steering knuckle and slide caliper off disc. Use a piece of wire to attach caliper to frame.

CAUTION: Do not allow caliper to hang from brake line, as the line may be damaged.

9. Disengage spherical joint stud and remove from steering knuckle.
10. Remove upper control arm cam assemblies and remove control arm from car.

b. Installation

1. Guide upper control arm over shock absorber and install bushing ends into frame mounts.
2. Install cam assemblies as shown in Fig. 3-41. Both cams should be mounted with bolt hole downward.
3. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.
4. Install upper spherical joint into steering knuckle.
5. Install brake caliper following procedure in Section 5, Note 12c, Steps 1 through 10, and Step 20.

CAUTION: Do not twist brake hose on installation, as brake system damage may result.

6. Install brake hose clip, nut, and cotter pin on upper spherical joint stud. Tighten nut to 60 foot-pounds.

CAUTION: See Page 3-6.

CAUTION: Cotter pin must be crimped toward upper control arm to prevent damage to the outer constant velocity joint seal. If cotter pin cannot be installed in this position, tighten nut further until insertion is possible.

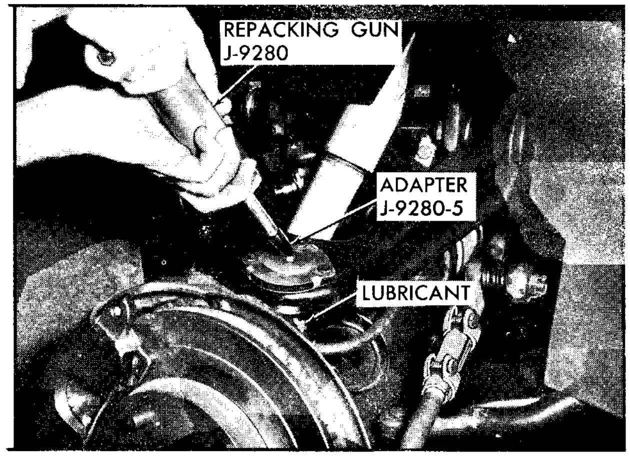


Fig. 3-47 Repacking Upper Spherical Joint (Eldorado)

7. Install wheel and tire. Tighten nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

8. Raise car. Remove jack stands and lower car.
9. Check standing height as described in Note 19 and adjust.
10. Check caster, camber, and toe-in as described in Note 20 and adjust.

26. Upper Control Arm Spherical Joint

a. Removal

1. Remove upper control arm as described in Note 25a.

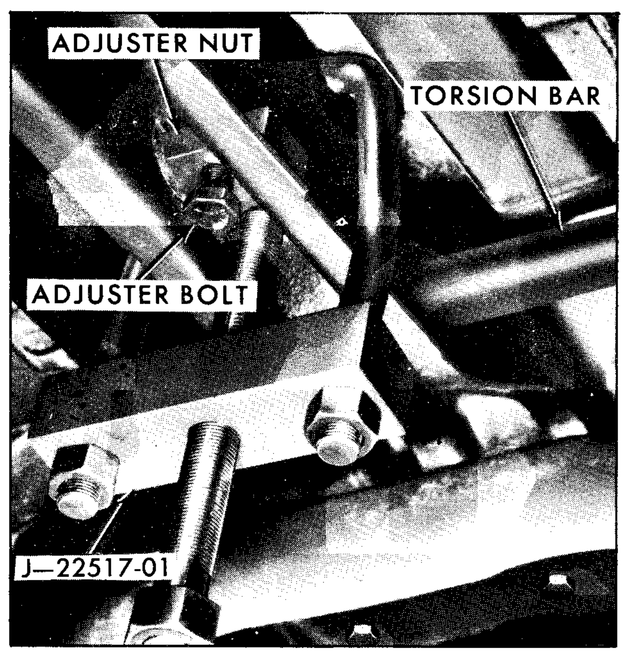


Fig. 3-48 Removing And Installing Torsion Bar

2. Place upper control arm on workbench and grind the heads off three rivets.

3. Using a hammer and punch, drive on center of rivets until spherical joint can be removed from control arm.

b. Installation

1. Install new spherical joint in upper control arm.
2. Install four bolts in top side of control arm.
3. Install four nuts from under side of control arm. Tighten nuts to 25 foot-pounds.
4. Install upper control arm as described in Note 25b.

CAUTION: See Page 3-6.

5. Remove plug from top of spherical joint and repack joint using Repacking Gun, J-9280, and Adapter, J-9280-5. Apply special lubricant recommended for this application until lubricant escapes between seal and steering knuckle. Reinstall plug, Fig. 3-47.

27. Torsion Bar

a. Removal

1. Raise car so that front suspension is allowed to hang at full rebound position.
2. Remove adjusting bolt from both torsion bar adjuster nuts.
3. Install Torsion Bar Remover and Installer, J-22517-01, on torsion bar cross member, Fig. 3-48.

(NOTE: Install Torsion Bar Remover U-bolt on cross member. If clearance is insufficient, pry between cross member and underbody until tool falls in place, Fig. 3-49. Next, install Torsion Bar Remover Base on U-bolt and install two locknuts on U-bolt. Make certain Base is installed flush with last thread on U-bolt and install center bolt.)

4. Tighten center bolt until torsion bar adjusting arm is raised high enough to permit removal of adjuster nut. Remove adjuster nut.
5. Loosen remover tool center bolt until it is free of the adjusting arm.
6. Repeat Steps 3 and 4 on other end of cross member and remove tool from cross member.
7. Remove parking brake cable from guide at right side of underbody.

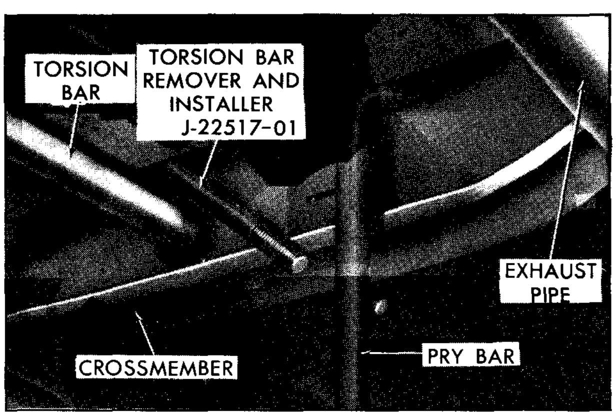


Fig. 3-49 Prying At Crossmember And Underbody

8. Remove torsion bar cross member bolts, nuts, shim, and retainer from both ends of cross member.
9. Move cross member as far as possible toward the side opposite the side from which torsion bar is to be removed. One end of cross member should now be clear of frame.
10. Lower end of cross member from frame, then drive cross member rearward until torsion bar is free of cross member.

CAUTION: Take care not to damage parking brake cable when lowering cross member. If additional slack is required, loosen parking brake cable adjustment nut at equalizer.

(NOTE: Although it is possible to remove both torsion bars at this point, installation is easier if either left or right bar is mounted at all times.)

11. Remove torsion bar from connector at lower control arm.

b. Installation

1. Check torsion bar for deep nicks, scratches, dents, or splits along the seam. If these conditions exist, torsion bar must be replaced.
2. Lubricate three inches of each end of torsion bar with special lubricant, Part No. 998 5092 or equivalent.

(NOTE: Torsion bars are stamped with letters "L" for left and "R" for right. The stamped end is installed in the lower control arm connector.)

3. Slide torsion bar all the way into lower control arm connector.
4. Position torsion bar adjusting arm in cross member. Holding adjusting arm in place, slide torsion bar rearward until bar is seated in adjusting arm.

At this point, tape on torsion bar near lower control arm connector should be fully visible but within 1/4" of connector.

5. Position cross member on frame.

(NOTE: If both torsion bars are to be removed, remove opposite bar at this time following procedure of Part a, beginning with Step 9.)

6. Install shim between cross member and frame on each side, and install retainer over cross member insulator.
7. Check both torsion bar adjusting arms for identical position with respect to torsion bar and cross member. Install cross member bolts and nuts, tightening to 120 inch-pounds.
8. Install parking brake cable through guide at right side of underbody. If cable was loosened at equalizer, adjust at this time, Section 5, Note 8.
9. Install Torsion Bar Remover and Installer, J-22517-01, Fig. 3-48.

(NOTE: When installing Torsion Bar Remover and Installer, J-22517-01 follow steps 3 and 4 of Part a of this procedure.)

10. Tighten center bolt on Torsion Bar Remover and Installer, J-22517-01 until torsion bar adjusting arm is raised high enough to permit installation of adjuster nut. Install adjuster nut.

11. Remove Torsion Bar Remover and Installer, J-22517-01 and install on other end of cross member.

12. Repeat steps 9 and 10 for other torsion bar.

13. Remove Torsion Bar Remover and Installer J-22517-01.

14. Using new torsion bar adjusting bolts, lubricate threads on bolts and install bolts into adjuster nuts on both sides of car.

15. Check standing height and adjust as required.

16. Check front wheel alignment and adjust if necessary.

28. Steering Knuckle and Inner Seal

a. Removal

1. Remove wheel disc.
2. Remove drive axle cotter pin and loosen nut.
3. Loosen wheel mounting nuts.
4. Raise car and place jack stands under lower control arms.
5. Remove drive axle to hub nut and washer and wheel mounting nuts.
6. Remove wheel and tire.
7. Remove upper spherical joint cotter pin and nut.
8. Remove brake line hose clip from upper spherical joint stud, but do not loosen spherical joint stud.
9. Install one or two wheel mounting nuts to prevent disc from falling off hub while removing caliper.
10. Remove two bolts securing caliper to knuckle and slide caliper off knuckle.

CAUTION: Never suspend caliper by brake hose, as the brake hose may become damaged. Use a length of wire to attach caliper to frame.

11. Remove nuts used to retain disc. Mark hub and disc for alignment on assembly and remove disc from hub.
12. Place a short length of rubber hose over the lower control arm torsion bar connector to avoid damage to inboard tri-pot joint seal lip, Fig. 3-50.
13. Position brake hose out of way and, using hammer, strike steering knuckle in area of upper spherical joint and loosen upper spherical joint stud.

CAUTION: Use care to prevent hammer from slipping and damaging brake hose or caliper.

14. Remove cotter pin and nut from tie-rod end.
15. Remove tie-rod end from steering knuckle using Front Suspension Puller, J-24319.
16. Remove cotter pin and nut from lower spherical joint stud.
17. Using Front Suspension Puller, J-24319, disconnect lower spherical joint at steering knuckle.
18. Guide hub and knuckle assembly over end of drive axle and remove from car.

(NOTE: If knuckle is being replaced, remove hub, bearings, cups, and seals as described in Note 33.)

19. To remove steering knuckle inner seal, use a screwdriver, Fig. 3-51.

b. Cleaning and Inspection

Inspect seal surface in the steering knuckle bore and the seal contact surface on the drive axle. Remove any rust present, using #400 grit "wet" paper and kerosene. When sanding, use a circular motion only, to avoid spiral marks on sealing surfaces.

c. Installation

If knuckle is being replaced, install hub, bearings, bearing cups, and seals as described in Note 33 before beginning this procedure.

1. Apply a moderate amount of high melting point lithium base grease between lips of steering knuckle inner seal, Fig. 3-52.
2. Undercut webbing on Seal Installer, J-23115, so that Installer will accept seal.
3. Install seal on Seal Installer, J-23115.
4. Position knuckle and hub assembly on arbor press, Fig. 3-53.

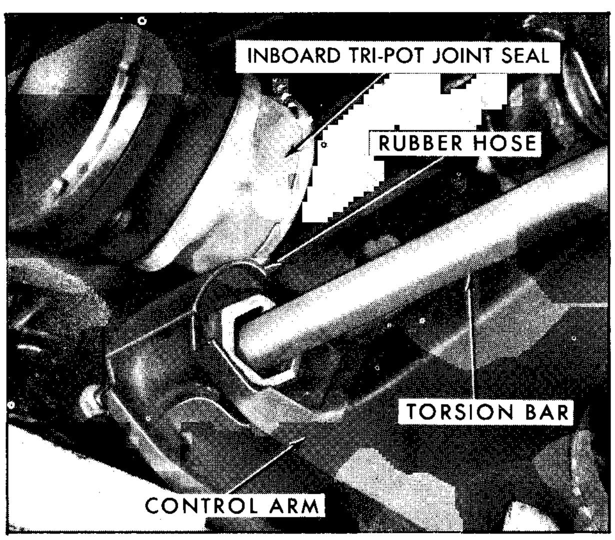


Fig. 3-50 Rubber Hose Location

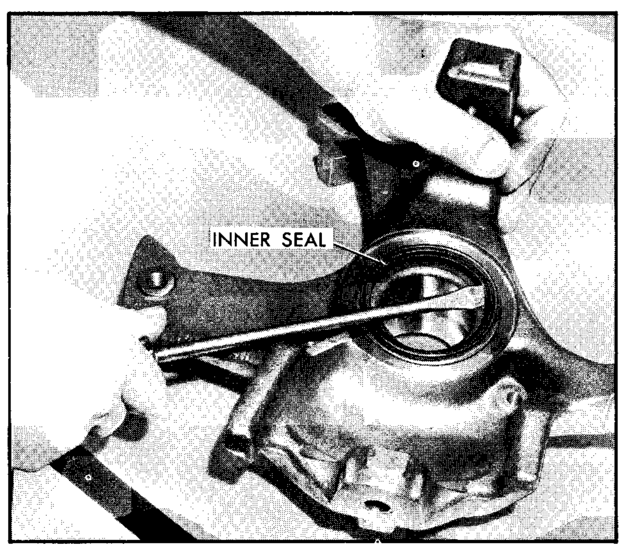


Fig. 3-51 Removing Steering Knuckle Inner Seal

Fig. 3-52 Lubricating Steering Knuckle Seal

(NOTE: Support hub and knuckle assembly so that assembly is not supported by the wheel mounting studs.)

5. Position seal and Seal Installer, J-23115, on knuckle and press seal into knuckle, Fig. 3-53.
6. Align splines in hub with splines on drive axle and install hub and knuckle assembly on drive axle.

CAUTION: Use care to avoid damaging the inner seal when installing the knuckle on the drive axle.

7. Install lower spherical joint stud into steering knuckle and attach nut. Do not tighten nut at this time.

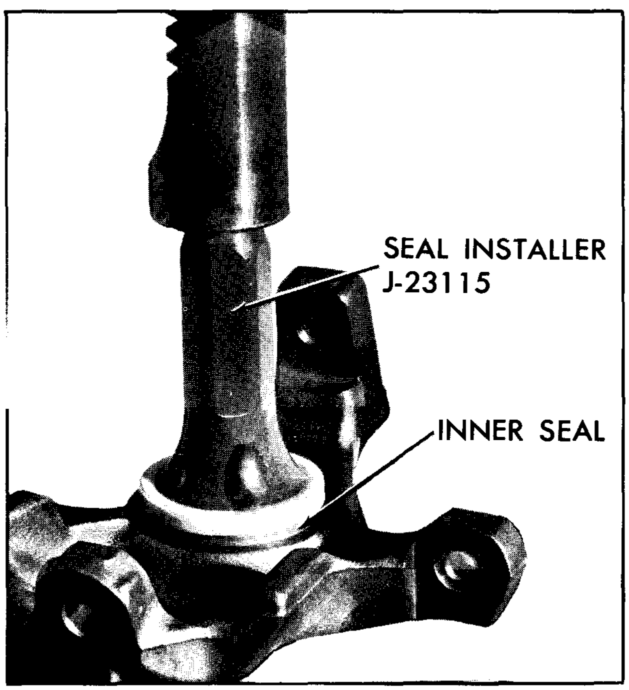


Fig. 3-53 Installing Inner Seal In Knuckle

8. Install tie-rod end stud into knuckle and attach nut. Do not tighten nut at this time.
9. Install upper spherical joint stud into knuckle and install upper spherical joint nut loosely.
10. Using alignment marks placed on hub and disc at time of disassembly, align and install disc on hub.
11. Loosely install two nuts on hub to prevent disc from falling off hub.
12. Install caliper as described in Section 5, Note 12c, Steps 1 through 10, and Step 20.

CAUTION: Do not twist brake hose during installation, as brake system damage may result.

13. Remove upper spherical joint nut to install brake hose clip on stud.
14. Install upper spherical joint nut, tighten nut to 60 foot-pounds, and install new cotter pin. Bend cotter pin tight against flats on nut.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: Cotter pin must be crimped tight against flat on nut to prevent interference with or damage to the drive-axle constant velocity joint or seal.

15. Tighten tie-rod end nut to 40 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

16. Tighten nut on lower spherical joint stud to 80 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole.)

17. Remove rubber hose from lower control arm torsion bar connector, Fig. 3-50.
18. Install drive axle washer and nut. Do not tighten nut at this time.
19. Install wheel and tire.
20. Install wheel mounting nuts; turn up snug, but do not tighten nuts at this time.
21. Raise car, remove jack stands, and lower car.
22. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

23. Tighten drive axle to hub nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole.)

24. Install wheel disc.
25. Check standing height and front end alignment and adjust as required.
26. With vehicle weight supported by front wheels, inspect front brake hose to be sure it is not twisted.

29. Lower Control Arm Spherical Joint Seal

The lower spherical joint seal can be installed with the lower control arm either on or off the car.

a. Removal (On Car)

1. Remove steering knuckle as described in Note 28a.
2. Using a hammer, tap lightly on seal retainer.
3. Use a small screwdriver to work retainer off joint. Discard seal and retainer.
4. Wipe grease from spherical joint and stud.

b. Installation

1. Position new seal over spherical joint stud.
2. Lubricate jaws of Camber Adjusting Wrench, J-9231, and slide jaw between seal and retainer.
3. Tap lightly with hammer on end of Camber Adjusting Wrench, J-9231, until seal retainer is fully seated.
4. Install steering knuckle as described in Note 28c.
5. Remove plug from spherical joint and repack joint using repacking gun, J-9280 and Adapter J-9280-5. Apply special lubricant recommended for this application until lubricant escapes from valve inside of seal, Fig. 3-54. Reinstall plug.

30. Lower Control Arm

The lower control arm components are serviced as individual parts.

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Remove hub cotter pin and loosen nut.
4. Raise car.
5. Remove wheel and tire.

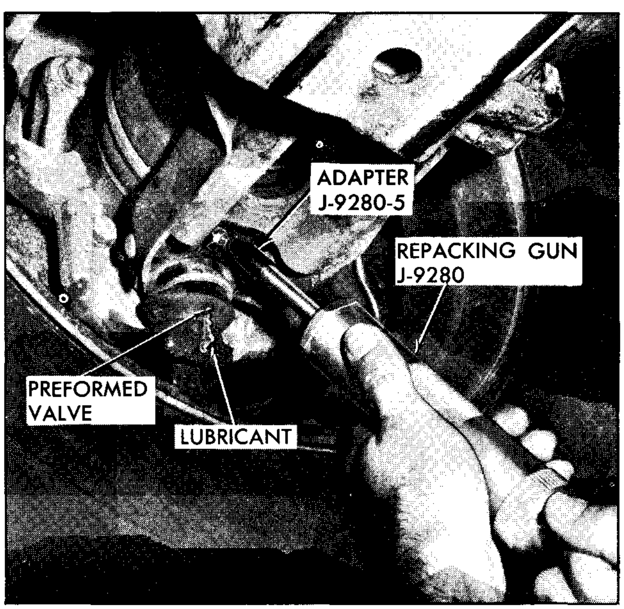


Fig. 3-54 Repacking Lower Spherical Joint Seal

6. Remove torsion bar as described in Note 27a.
7. Remove hub nut and washer.
8. Remove brake hose clip(s) attached to frame.

(NOTE: Right side of car has two frame attaching clips.)

9. Remove cotter pin, nut, and brake hose clip from upper spherical joint stud.
10. Using a hammer, strike knuckle in area of upper spherical joint and remove joint from steering knuckle.

CAUTION: Use care to prevent hammer from slipping and damaging brake hose.

11. Disconnect shock absorber at lower mount, then work shock off mount using a screwdriver to pry bushing off stud.
12. Using Front Suspension Puller, J-24319, disconnect tie rod end at steering knuckle.
13. Disconnect stabilizer bar and disconnect nut and link bolt.
14. Using Front Suspension Puller, J-24319, disconnect lower spherical joint.
15. Disengage hub, knuckle, and disc as an assembly from drive axle and secure assembly to upper control arm with a piece of wire.

CAUTION: Take care to avoid damaging brake hose.

16. Remove lower control arm to frame attaching nuts and bolts.
17. Disengage lower control arm from frame mounts and remove control arm.

b. Installation

1. Remove wire and install hub, disc, and knuckle assembly on drive axle.
2. Install lower control arm into mounts in chassis. Do not tighten nuts at this time.
3. Install lower control arm spherical joint into steering knuckle. Tighten nut to 80 foot-pounds and install new cotter pin. (If pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: See Page 3-6.

4. Tighten lower control arm inner mount bolts to 80 foot-pounds.

CAUTION: See Page 3-6.

5. Lift up upper control arm and install shock absorber on lower control arm mount. Tighten nut to 75 foot-pounds.
6. Install upper control arm spherical joint into steering knuckle.
7. Install brake hose clip on upper spherical joint stud. Tighten nut to 60 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole. Cotter pin must be crimped tight against flats on nut to prevent cotter pin from interfering with outer constant velocity joint seal.)

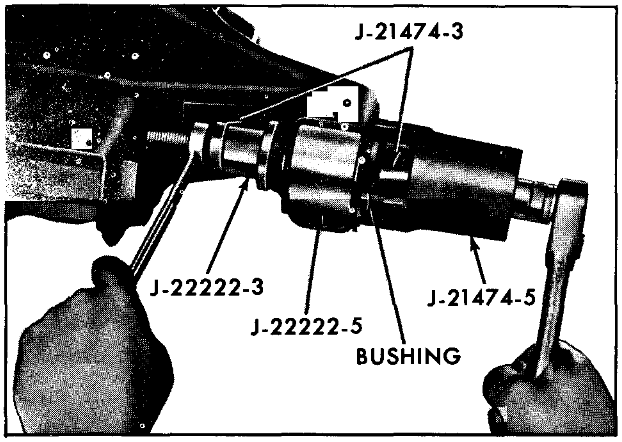


Fig. 3-55 Removing Front Lower Control Arm Bushings

8. Install brake hose clip(s) to frame. (Right side of car has two frame attaching clips.)

9. Install tie rod end in steering knuckle. Tighten nut to 40 foot-pounds, and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

10. Install stabilizer bar on control arm as described in Note 22b.

11. Install washer and nut securing hub to drive axle.

12. Install torsion bar as described in Note 27b.

13. Install wheel and tire.

14. Lower car and examine brake lines to be sure they are not twisted.

15. Tighten drive axle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: , If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.)

16. Tighten wheel nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

17. Adjust standing height and front wheel alignment as described in Notes 19 and 20.

18. Install wheel disc.

31. Lower Control Arm Bushings

a. Removal

1. Remove lower control arm as described in Note 30a.

(NOTE: Spray bushings with silicone lubricant to facilitate removal.)

2. Install tools as shown in Fig. 3-55 and press bushings out of control arm.

b. Installation

(NOTE: Dual rate bushings, which must be oriented in the arm at installation, are used in the lower control arms.)

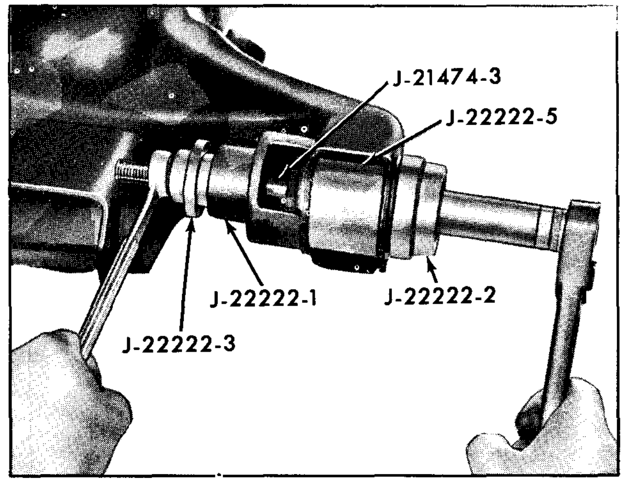


Fig. 3-56 Installing Front Lower Control Arm Bushings

1. Invert the arm on a flat table surface. A 9/16" height difference must be obtained between the spherical joint end of the arm, Fig. 3-40 and the flat table surface.

2. Position the bushings so the centerline of the notches in the bushings are parallel with the flat table surface on which the arm rests, Fig. 3-39.

(NOTE: Spray bushings with silicone lubricant to facilitate installation.)

3. Install tools as shown in Fig. 3-56, and press bushings into lower control arm.

4. Install lower control arm as described in Note 30b.

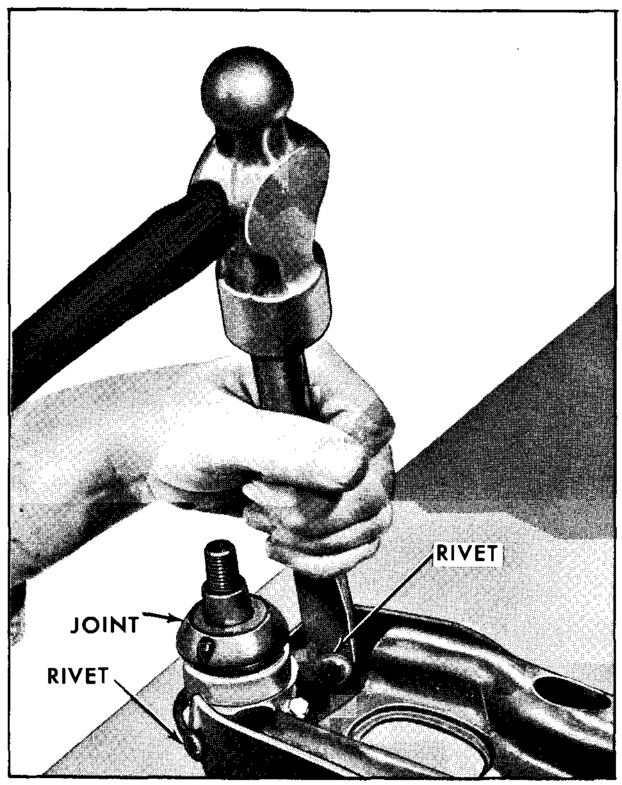


Fig. 3-57 Removing Lower Spherical Joint Rivets

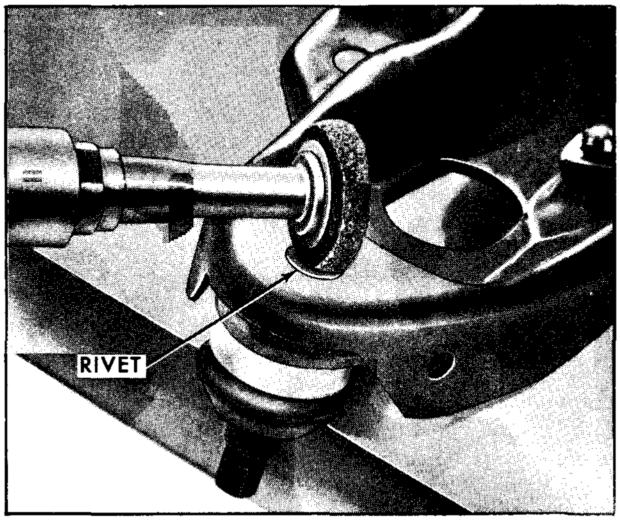


Fig. 3-58 Removing Lower Spherical Joint Center Rivet

5. Check standing height and front wheel alignment and adjust as necessary, Notes 19 and 20.

32. Lower Control Arm Spherical Joint

a. Removal

1. Remove lower control arm as described in Note 30a.
2. Place lower control arm on bench with spherical joint stud up.
3. Using a chisel, cut two rivet heads off as shown in Fig. 3-57.
4. Place lower control arm right side up and grind large rivet head off as shown in Fig. 3-58.
5. Using a hammer and punch, drive on center rivet of joint until joint is out of control arm.

Fig. 3-59 Lower Spherical Joint Installed

b. Installation

1. Install service spherical joint into control arm as shown in Fig. 3-59 and tighten bolts and nut.
2. Install lower control arm as described in Note 30b.

33. Hub Bearing, and Knuckle Assembly (Fig. 3-60)

a. Removal

1. Remove wheel disc.

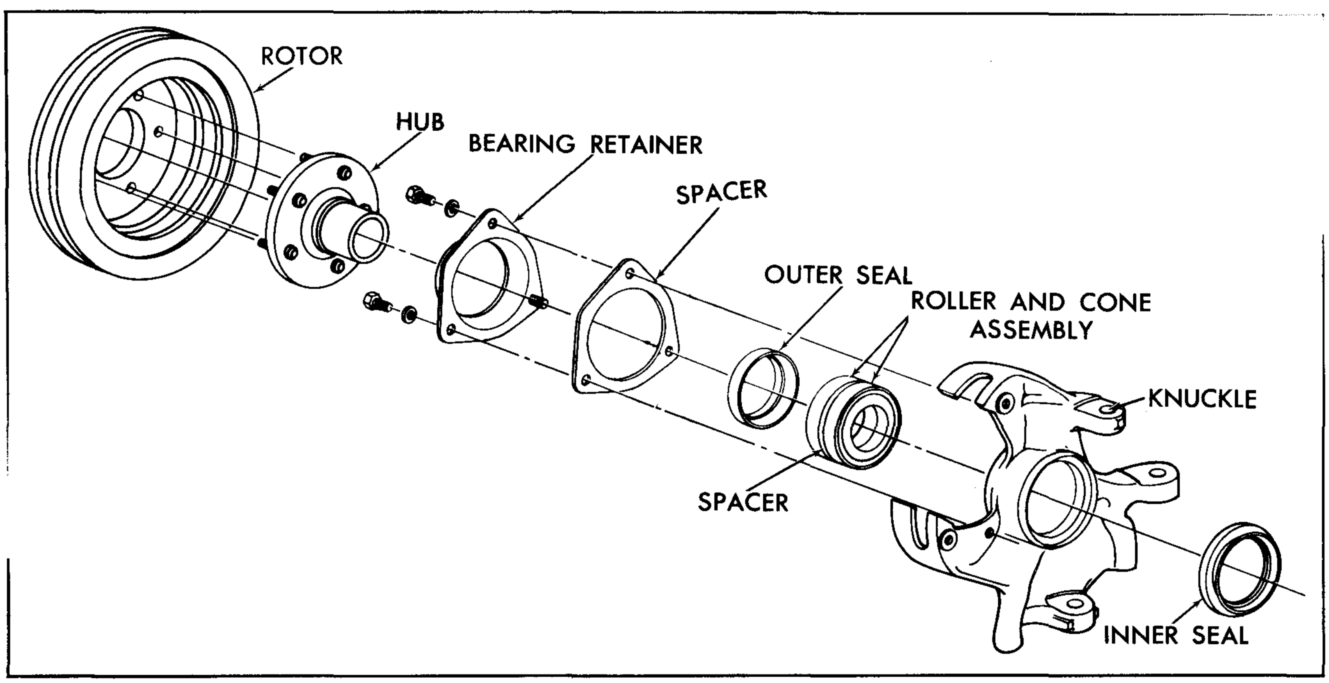


Fig. 3-60 Front Hub, Bearing And Knuckle Disassembled (Eldorado)

2. Loosen wheel mounting nuts.
3. Remove drive axle cotter pin.
4. Loosen drive axle nut.
5. Raise car and place jack stands under lower control arms.
6. Remove drive axle nut, washer, and wheel mounting nuts, and remove wheel and tire.
7. Remove upper spherical joint cotter pin and loosen nut. Remove nut and brake hose clip from stud, then re-install nut.
8. Remove two bolts securing caliper to knuckle and slide caliper off disc.
9. Position brake hose and caliper out of way.

CAUTION: Do not allow caliper to hang from the brake hose, as the brake hose may become damaged.

10. Mark hub and disc for alignment on assembly and remove disc.
11. Strike steering knuckle in area of upper spherical joint until upper spherical joint is loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging brake hose.

12. Install a short length of rubber hose over the lower control arm torsion bar connector to avoid damage to inboard tri-pot joint seal when hub and knuckle are removed, Fig. 3-50.
13. Remove tie rod end cotter pin and nut.
14. Using Front Suspension Puller, J-24319, disconnect tie rod end at steering knuckle.
15. Remove lower spherical joint cotter pin and nut.
16. Using Front Suspension Puller, J-24319, disconnect lower spherical joint.
17. Remove upper spherical joint nut.
18. Remove upper spherical joint stud from steering knuckle.

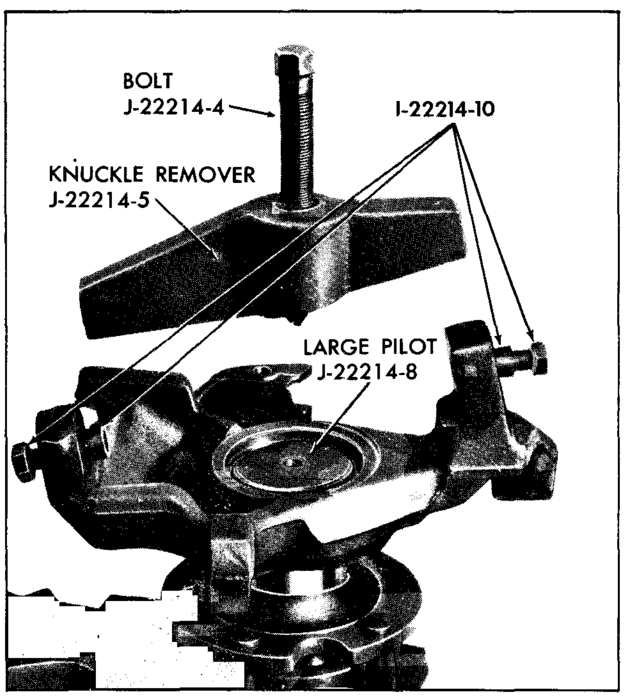


Fig. 3-61 Hub And Bearing Removal Tools

19. Remove hub and knuckle as an assembly.

b. Disassembly

1. Remove three screws and washers securing spacer and bearing retainer to steering knuckle and remove spacer.
2. Remove steering knuckle inner seal, Fig. 3-51 and discard seal.

CAUTION: Use care when removing seal to prevent damage to the seal mating surface on the steering knuckle.

3. Install Small Bushing, part of set J-22214-10, in upper end of steering knuckle, Fig. 3-61.
4. Install Large Bushing, part of set J-22214-10, in lower end of steering knuckle, Fig. 3-61.
5. Install Large Pilot, J-22214-8, on inner end of hub, Fig. 3-61.
6. Install Knuckle Remover, J-22214-5, between upper and lower ends of steering knuckle, Fig. 3-61.
7. Secure Knuckle Remover to steering knuckle by installing two Small Bolts, J-22214, through bushings previously installed.
8. Secure Knuckle Remover, J-22214-5, in a vise, with knuckle assembly attached, Fig. 3-62.
9. Coat Large Bolt, J-22214-4, with chassis lubricant and install bolt in Knuckle Remover, J-22214-5.
10. Tighten Large Bolt, J-22214-4, until hub, bearing, retainer, spacer, steering knuckle outer seal, and bearing assembly are pressed out of steering knuckle.
11. Remove spacer.
12. Pry outer seal away from bearing package, Fig. 3-63.

(NOTE: A simple tool such as the one described in Fig. 3-33 is ideal for this prying operation. This can be made from an old screwdriver or a piece of cold rolled steel.)

13. Use a hammer and a 3/8" chisel to cut through outer seal. Then remove seal from bearings, Fig. 3-63.

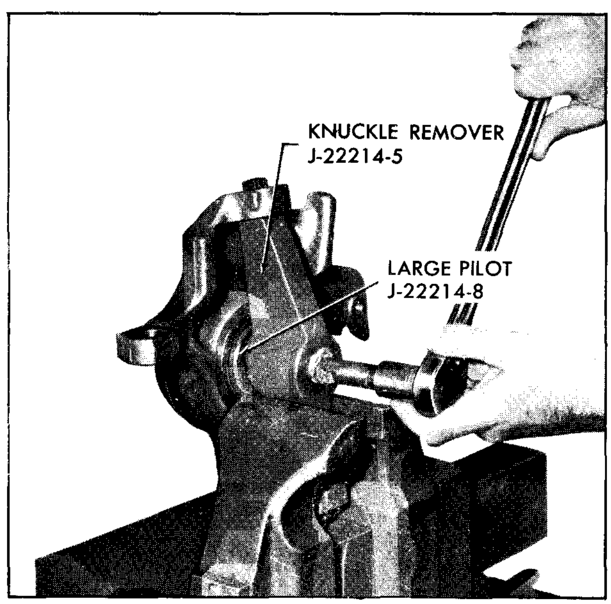


Fig. 3-62 Removing Hub And Bearings From Knuckle

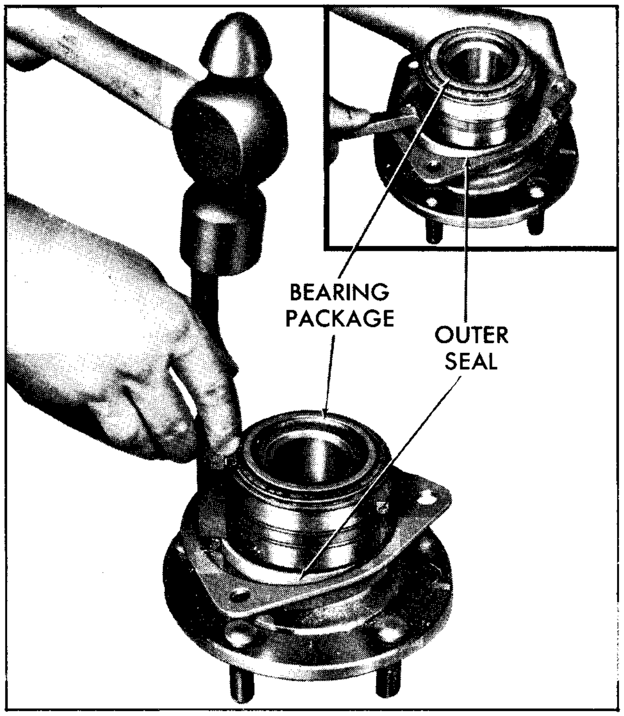


Fig. 3-63 Removing Outer Seal From Bearings

CAUTION: When chiseling, hold hammer and chisel in a strictly vertical position to avoid damaging hub.

14. Place assembly in arbor press so that hole in Press Plate, J-23997, lines up with hole in anvil. Press bearings from hub, Fig. 3-64.

c. Assembly

The front wheel bearings are supplied as matched assemblies and must be serviced as complete assemblies.

Inspect the steering knuckle bore and the steering knuckle seal contact surface on the drive axle. Remove any rust present using #400 grit "wet" paper and kerosene. When sanding, use a circular motion only to avoid spiral marks on sealing surface.

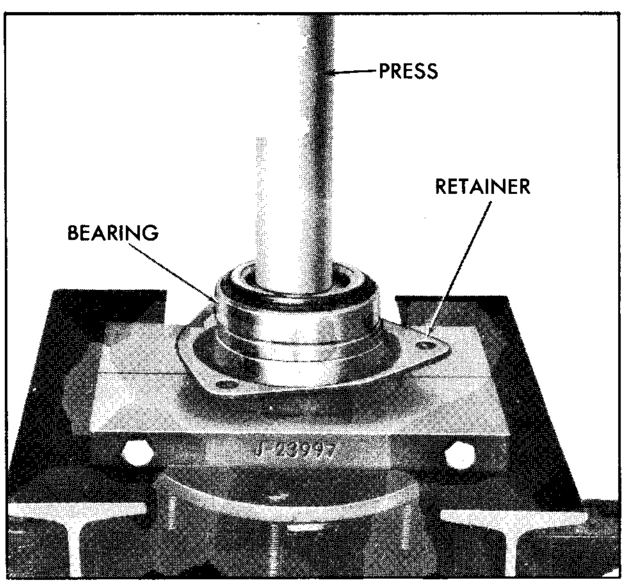


Fig. 3-64 Removing Bearings From Hub

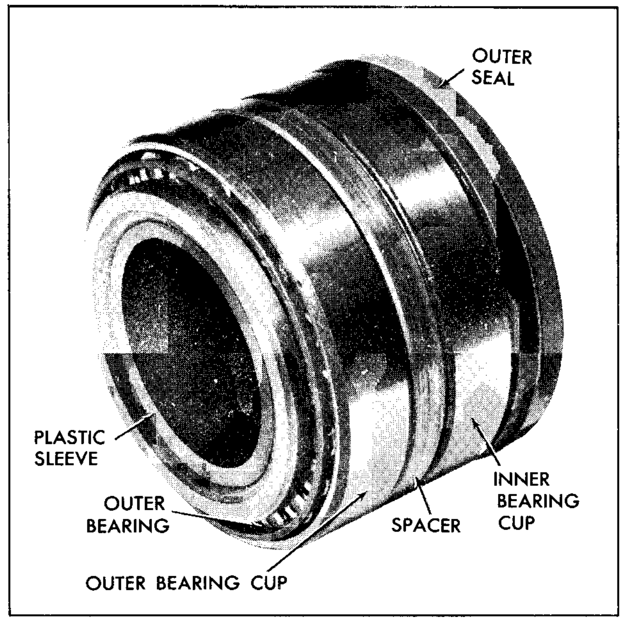


Fig. 3-65 Bearing Package

1. Position steering knuckle on arbor press with outboard face of knuckle facing up.
2. Using special lubricant provided in bearing package, apply lubricant to hub shaft and between lips of both steering knuckle seals, Fig. 3-52.

(NOTE: One tube of lubricant will service one complete hub and knuckle assembly.)

3. Install outer steering knuckle seal on Seal Installer, J-23114.

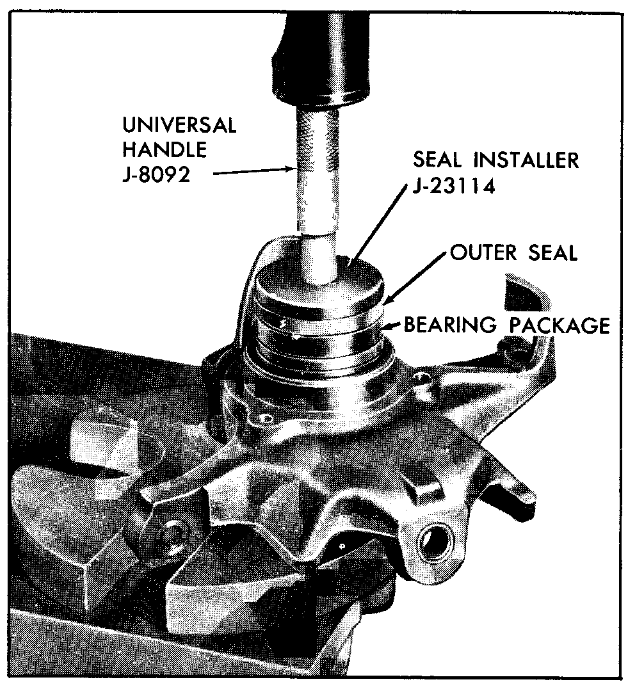


Fig. 3-66 Installing Bearing Package

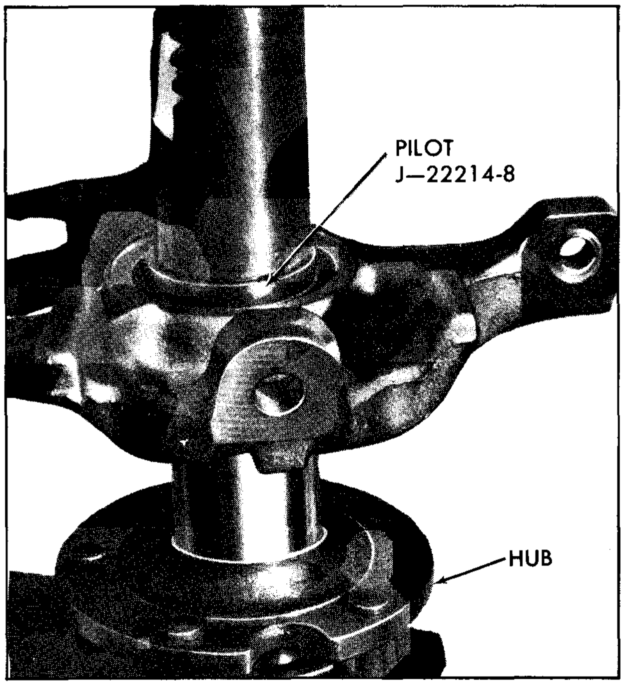


Fig. 3-67 Installing Hub In Knuckle

4. Position seal and seal installer on bearing package and position package in steering knuckle bore.

CAUTION: Do not remove disposable sleeve in bearing package at this time, as sleeve is used as a retainer to prevent bearings from being mispositioned in cups, or damaged during installation, Fig. 3-65.

5. Press bearing package and outer seal into steering knuckle, Fig. 3-66. Bearing package and outer seal are installed when inner bearing cup bottoms out on shoulder in steering knuckle bore.
6. Position spacer on outer face of steering knuckle.
7. Position bearing retainer over spacer and secure bearing retainer and spacer to steering knuckle with three screws and washers. Tighten screws to 30 foot-pounds. Remove knuckle assembly from press.
8. Remove disposable sleeve from bearing package previously installed in steering knuckle.
9. Working from inner face of steering knuckle, use remainder of special lubricant to coat inner race of bearings before installing hub in knuckle and bearing assembly.
10. Position hub on arbor press with stud end down.

CAUTION: To avoid damaging the mounting studs, support hub so that hub is not supported by the wheel mounting studs.

11. Position knuckle and bearing assembly on hub.
12. Install Large Pilot, J-22214-8, through steering knuckle so that pilot seats on bearing, Fig. 3-67, and press knuckle assembly on hub.
13. Install inner seal on Seal Installer, J-23115, and press inner seal into steering knuckle, Fig. 3-53.

(NOTE: Webbing of Seal Installer, J-23115, may have to be undercut before tool will accept seal.)

d. Installation

1. Guide knuckle assembly over drive axle, install lower spherical joint stud into knuckle, and attach nut. Do not tighten nut at this time.

CAUTION: Use care to avoid damaging inner seal when guiding the knuckle over the drive axle.

2. Install tie-rod end stud into knuckle and attach nut. Do not tighten nut at this time.
3. Install upper spherical joint stud into knuckle and install upper spherical joint stud nut loosely.
4. Using alignment marks placed on hub and disc at time of disassembly, align disc with hub and install disc on hub.
5. Install one or two nuts on hub to prevent disc from falling or being knocked off hub.
6. Install caliper as described in Section 5, Note 12c, Steps 1 through 10 and Step 20.

(NOTE: Remove upper spherical joint nut to install brake hose clip on stud. Take care not to twist brake hose during caliper installation.)

7. Install upper spherical joint nut, tighten nut to 60 foot-pounds and install new cotter pin. Bend cotter pin tight against flats on nut.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin. Cotter pin must be crimped tight against flats on nut to prevent interference with or damage to the drive axle constant velocity joint or seal.)

8. Tighten tie-rod end nut to 40 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

9. Tighten nut on lower spherical joint stud to 80 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

10. Remove rubber hose from lower control arm torsion bar connector.
11. Install drive axle washer and nut. Do not tighten nut at this time.
12. Remove nuts used to hold disc on hub, and install wheel and tire.
13. Install wheel mounting nuts; turn up snug, but do not tighten nuts at this time.
14. Raise car, remove jack stands, and lower car.
15. Inspect front brake hose to make sure it is not twisted.
16. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

17. Tighten drive axle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

18. Check standing height and front end alignment and adjust as required, Notes 19 and 20.

19. Install wheel disc.

GENERAL DESCRIPTION

(NOTE: The following information is applicable only to the Eldorado.)

The front wheel drive system consists of a final drive unit, right and left output shafts, and right and left drive axles.

The final drive assembly includes a spiral bevel ring and pinion gear set with a ratio of 3.07:1 (2.73:1 optional) and a spur bevel differential gear set. The function of the unit is similar to that of a standard differential. The pinion gear is splined directly to the transmission, and the housing is secured to the transmission by eight fasteners: six screws, and two nuts that attach to studs in the transmission. The final drive housing is secured at its forward end by a support bracket which in turn is fastened to an engine mount bracket.

A twin gasket assembly is used between the final drive housing and cover to provide a controlled vent for excess lubricant.

Torque from the final drive is transmitted to the output shafts which connect to the drive axles. The output shafts are splined to the side gears in the final drive. The longer right output shaft requires a special support brace.

The drive axles, Fig. 3-68, are flexible assemblies, consisting of an axle shaft with a ball-type constant velocity joint at the outboard end and a tri-pot constant velocity joint at the inboard end. Tri-pot joints flex not only in respect to the angle through which they operate, but also in and out. This provides a means of lengthening and shortening of the drive axles as required by the front suspension as it travels through its ride motion.

The right drive axle incorporates a torsional damper.

DIAGNOSIS

CONDITION	CAUSE	CORRECTION
Clicking noise in turns.	Excessive wear or broken outboard joint.	Inspect and replace outboard joint if necessary.
Coast to drive "clunk".	Drive Axle to Output Shaft Screws.	Tighten to specified torque.
	Idle speed too high.	Adjust to specification.
	Inoperative rubber damper (RH side).	Replace right shaft and damper assembly.
	Loose spline RH damper to shaft.	Replace right shaft and damper assembly.
Shudder or vibration on acceleration.	Incorrect U-joint angle.	Check front standing height and correct if necessary.
	Excessive wear on inboard joint housing.	Check for brinelling of housing bores and replace if necessary.
	Worn spider assembly.	Check for wear or free rotation of balls on spider. Replace spider assembly if necessary.
Shimmy vibration at highway speeds.	Tires out of balance or out of round.	Balance front wheels. Replace if out of round.

SERVICE INFORMATION

The final drive unit is not serviced but is replaced as an assembly, with the exception of the following parts, which are serviced separately: pinion oil seal, output shaft seal, pinion bearing housing O-ring, vent pin, seal cover gasket, and filler plug gasket.

The drive axle outer constant velocity joints can be disassembled for repacking and replacement of seals. If any other defect is found, replace the joint as an assembly. The inboard tri-pot joints can be disassembled for repacking and replacement of the spider components, seals, and housing end cover O-ring.

CAUTION: Whenever any operations call for disconnection, connection, removal, or installation of the drive axles, extreme care must be exercised to prevent damage to the seals. When performing these operations, install a short length of rubber hose on the lower control arm torsion bar connector to prevent inboard tri-pot joint seals from being damaged.

CAUTION: When removing or installing the right drive axle, be sure to disconnect the negative battery cable. It is possible to short out the starter motor by making contact between the wrench and the starter motor terminals.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of

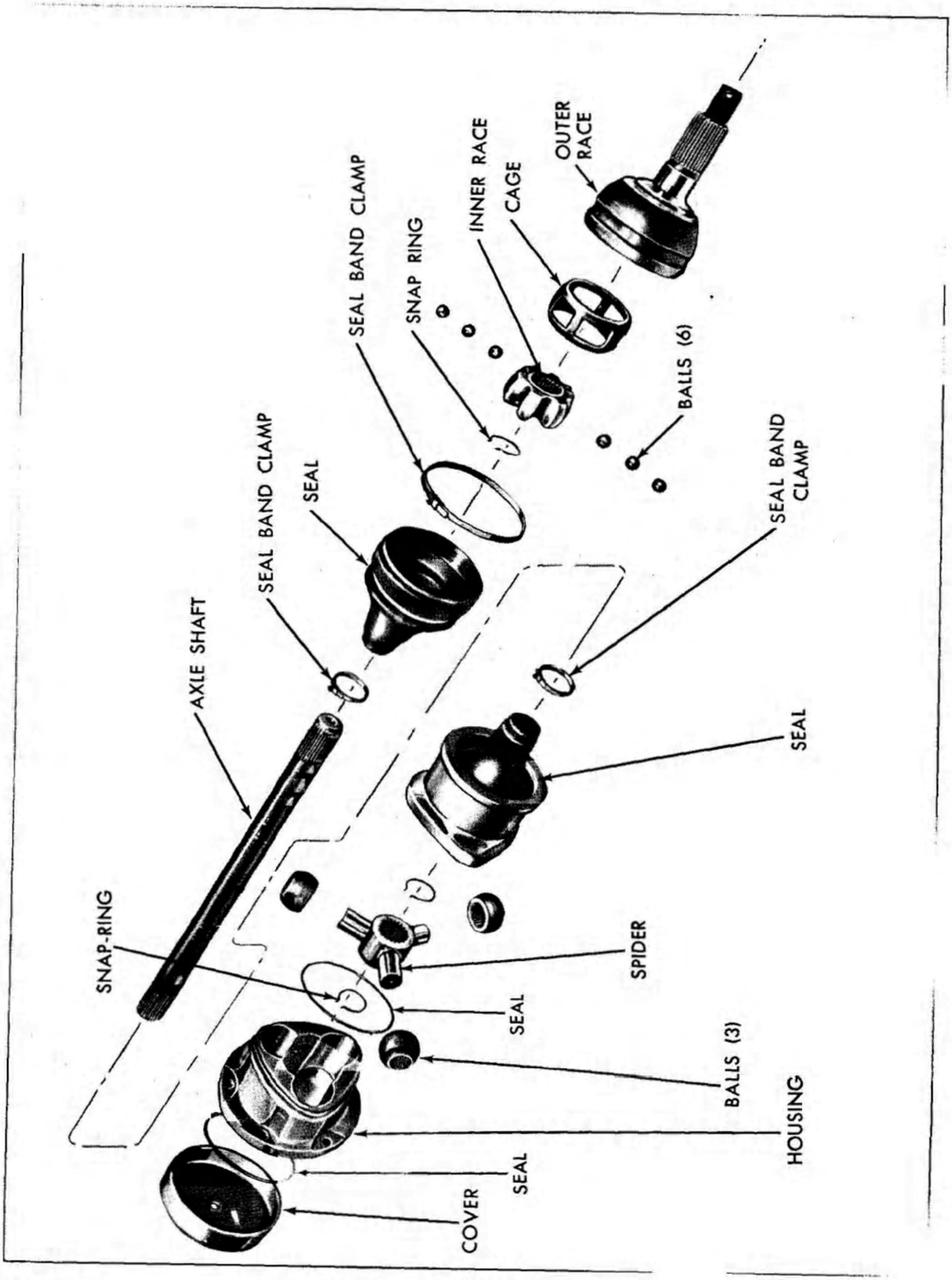


Fig. 3-68 Drive Axle Disassembled

the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, torsion bars, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

34. Right Output Shaft and Drive Axle

a. Removal

1. Disconnect negative battery cable.
2. Remove wheel disc.

(NOTE: If drive axle is to be removed, remove cotter pin and loosen but do not remove spindle nut.)

3. Raise car so that front vehicle weight is supported at lower control arms.
4. Loosen but do not remove right front shock absorber lower mounting nut and, using a screwdriver on the mount inner sleeve, pry shock absorber along lower mounting stud until it reaches nut.

CAUTION: Do not remove shock absorber from lower mount, because this may allow the lower control arm to drop.

5. Install a short length of rubber hose on both lower control arm torsion bar connectors, Fig. 3-50.
6. Remove six screws and lockwashers securing right drive axle to output shaft.
7. Move inboard end of drive axle rearward toward starter motor to gain access to output shaft.
8. Remove screw securing output shaft support strut to final drive housing, Fig. 3-69.
9. Remove two screws and flat washers securing right output shaft support to engine, Fig. 3-69.
10. Remove right output shaft, support, and strut as an assembly as follows: first, slide output shaft outboard to disengage splines; then move inboard end of assembly forward and downward until clear of car.

CAUTION: Take care to protect output shaft seal surface and splines from nicks or scratches.

11. If drive axle is to be removed, perform the following:

a. Using a block of wood and a hammer, strike end of drive axle to unseat axle at hub.

(NOTE: Spindle nut should be left on to retain axle but loose enough to allow unseating.)

b. Rotate axle inboard and toward front of car, guiding axle over front cross member and out from underside of car.

b. Installation

(NOTE: If drive axle was not removed, begin with Step 3.)

1. Guide drive axle into position from underside of car.

(NOTE: Guide axle up and over front cross member and engage drive axle splined end in knuckle and hub.)

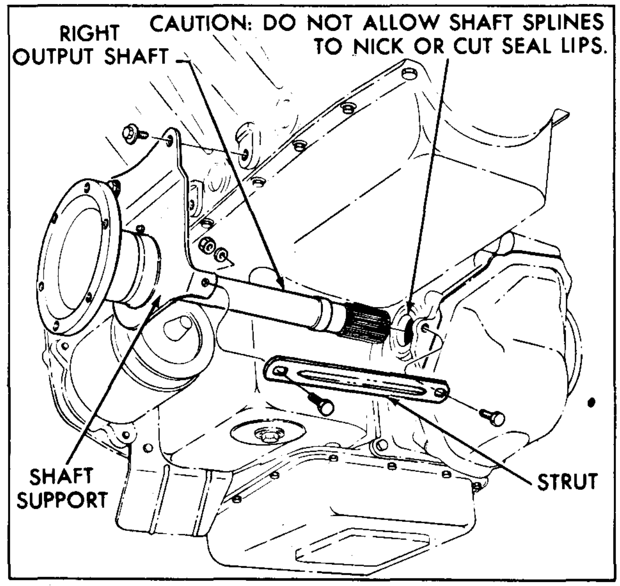


Fig. 3-69 Right Output Shaft

2. Rotate inner end of the drive axle rearward toward starter motor.
3. Apply clean front wheel bearing grease between lips of output shaft seal, then install output shaft into final drive unit from underside of car, indexing splines of output shaft with final drive.
4. Install two bolts and washers securing output shaft support to engine. Tighten bolts to 50 foot-pounds.

(NOTE: Seat washers in old grooves in output shaft support. If a new output shaft support is being installed, perform the following procedure: when attaching the right hand output shaft support to the engine block, do not let the shaft and support assembly hang in the final drive unit. Install support bolts and washers loosely, and by moving the flange end of the shaft up and down and back and forth, find the center location. Hold the shaft in this position and then tighten bolts to 50 foot-pounds.)

5. Install self-tapping screw securing output shaft support strut to final drive housing.
6. Rotate drive axle toward front of car and into position.
7. Install six new screws and lockwashers securing drive axle to output shaft. Tighten screws to 65 foot-pounds. Have a helper apply the brakes to prevent the drive axle from turning when installing screws.
8. Install drive axle spindle nut. Do not tighten nut at this time.
9. Lower car.
10. Tighten drive axle spindle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. If cotter pin cannot be installed, tighten nut to next hole.

CAUTION: See Page 3-6.

11. Connect negative battery cable.
12. Check final drive oil level and check for oil leaks at output shaft.

35. Left Output Shaft and Drive Axle

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Remove drive axle spindle nut cotter pin and loosen nut.
4. Raise car.
5. Remove wheel mounting nuts and drive axle spindle nut.
6. Remove wheel and tire.
7. Remove six drive axle to output shaft screws and lockwashers and discard screws and washers. Have a helper apply the brakes to prevent drive axle from rotating when removing screws.
8. Loosen shock absorber upper mount bolt.
9. Remove upper spherical joint cotter pin and nut, and remove brake hose clip from joint stud.
10. Using a hammer, strike knuckle in area of upper spherical joint. Lift up on upper arm and remove joint stud from steering knuckle.

CAUTION: Use extreme care to prevent hammer from slipping and damaging brake hose.

11. Remove brake hose bracket from frame.
12. Carefully tip disc and knuckle assembly out at upper end to extent of brake hose.

CAUTION: To prevent damaging the brake hose, wire assembly to upper control arm so that brake hose does not support the weight of the knuckle assembly.

13. Rotate inner end of drive axle toward front of car.
14. Guide drive axle out of knuckle and remove drive axle from car.
15. Remove left output shaft retaining bolt.

(NOTE: To remove bolt, install two screws in output shaft flange to prevent output shaft from rotating.)

16. Remove output shaft by pulling straight out toward side of car.

CAUTION: Use extreme care when removing output shaft to protect oil seal surface on shaft from nicks and scratches.

b. Installation

1. Apply clean wheel bearing grease between lips of final drive output shaft seal.
2. Install output shaft from underside of car.

CAUTION: Use extreme care when indexing output shaft splines with splines in final drive unit to prevent damage to the splines.

3. Install output shaft retaining bolt. Tighten bolt to 40 foot-pounds.

(NOTE: To install bolt, install two screws in output shaft flange to prevent output shaft from rotating.)

4. Guide drive axle into car and install drive axle spindle into steering knuckle.
5. Align drive axle inner joint flange with output shaft flange.
6. Install six new drive axle to output shaft screws and lockwashers. Tighten screws to 65 foot-pounds. Have helper apply brakes to prevent axle from rotating when installing screws.
7. Carefully remove wire supporting knuckle assembly, then lift up on upper control arm and install upper spherical joint stud in steering knuckle.
8. Install brake hose clip on upper spherical joint stud.
9. Install nut on upper spherical joint stud. Tighten nut to 60 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

10. Install brake hose bracket on frame.

CAUTION: Be careful not to twist brake hoses or otherwise damage the brake system.

11. Tighten shock absorber upper mount nut to 75 foot-pounds.
12. Install drive axle spindle washer and nut. Do not tighten nut at this time.
13. Install wheel and wheel mounting nuts. Do not tighten nuts at this time.
14. Remove rubber hose from lower control arm torsion bar connector and lower car.
15. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

16. Tighten drive axle spindle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin. If cotter pin holes do not line up at this position, tighten nut further until pin can be installed.

CAUTION: See Page 3-6.

17. Install wheel disc.
18. Check final drive oil level and check for leaks at output shaft.

36. Outer Constant Velocity Joint (Ball Type)

The outer constant velocity joints are replaced as an assembly and are disassembled for repacking and replacement of seals only.

a. Disassembly

1. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

CAUTION: Protect axle shaft to prevent jaw marks from vise. If right drive axle is being worked on, use extreme caution when clamping on torsional damper.

2. Remove inner and outer seal band clamps as shown in Fig. 3-70.
3. Slide seal down axle to gain access to the constant velocity joint. Wipe excess grease from joint to permit access to the snap ring.
4. Using Snap Ring Pliers, J-8059, spread snap ring and slide joint off axle spline as shown in Fig. 3-71.

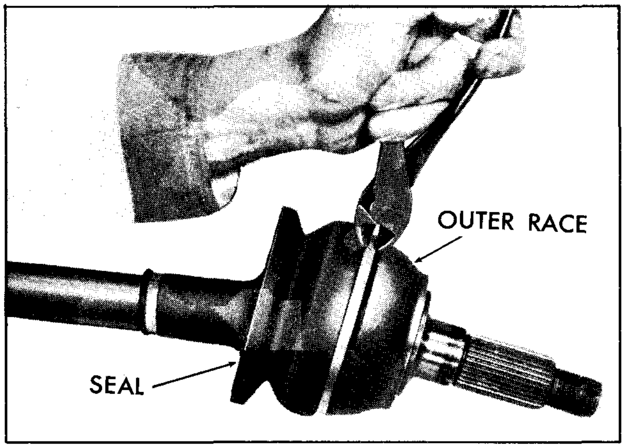


Fig. 3-70 Removing Seal Clamp Bands

5. Remove inner race snap ring as shown in Fig. 3-72.
6. Slide seal off axle shaft.
7. Insert joint in vise, clamping on shank. Use jaw blocks to prevent damage to joint shank.
8. Using a hammer and brass drift, tap on inner race until one ball can be removed, Fig. 3-73. Tip race in this manner to remove each ball. It may be necessary to pry last ball from cage with screwdriver.
9. Turn cage 90° as shown in Fig. 3-74 with slot in cage aligned with short land on outer race and lift cage out with inner race.
10. Turn short land of inner race 90° in line with hole in cage. Lift land on inner race up through hole in cage, then turn up and out to separate parts as shown in Fig. 3-75.

b. Cleaning and Inspection (Outer Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seals for damage or wear. If seals are damaged or worn, replace with new seals.

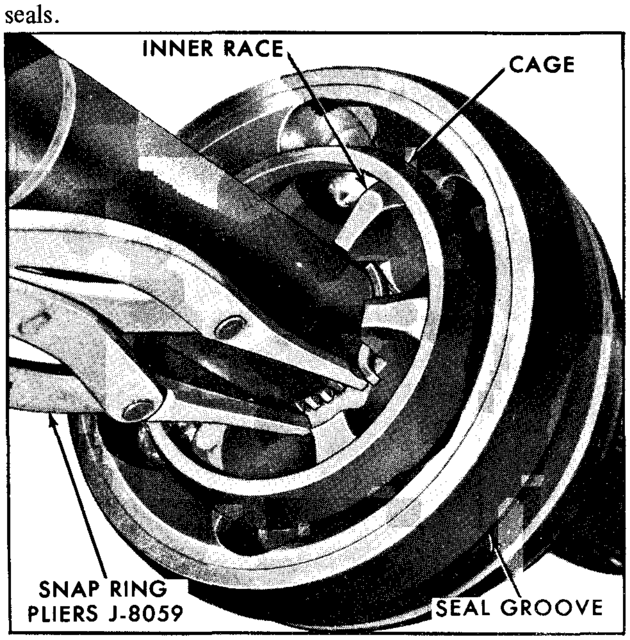


Fig. 3-71 Removing Outer Joint From Axle

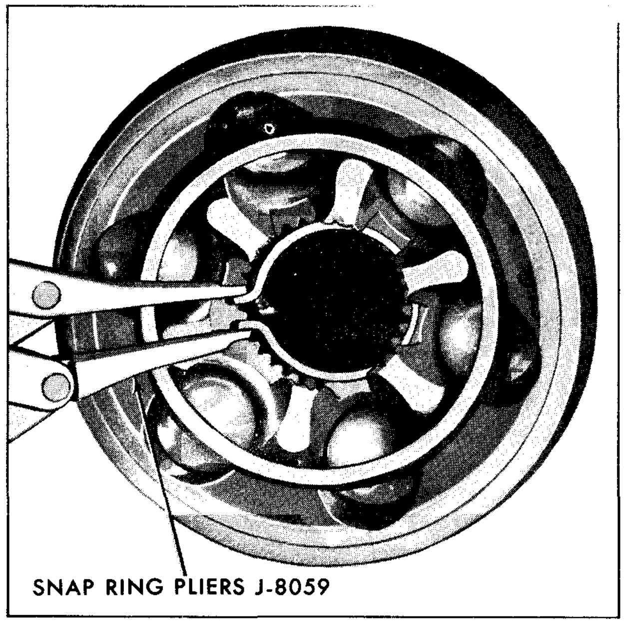


Fig. 3-72 Removing And Installing Inner Snap Ring

(NOTE: If any of the first four defects are found, the constant velocity joint assembly must be replaced as a unit.)

1. Inspect outer race for excessive wear or scoring in the ball grooves. Check housing splines and threads for any damage.
2. Inspect balls (six) for nicks, cracks, scores, or wear. Slight scuffing or nicking is considered normal.
3. Inspect cage for cracks, breaks, or excessive brinelling of the window flats.
4. Inspect inner race for excessive wear, scores, or cracks.

(NOTE: Inner and outer races may show a definite polished area where the balls travel but the CV joint need not be replaced. However, if the wear pattern is suspected to be the cause of a noisy or vibrating joint, replace joint.)

5. Inspect snap ring.

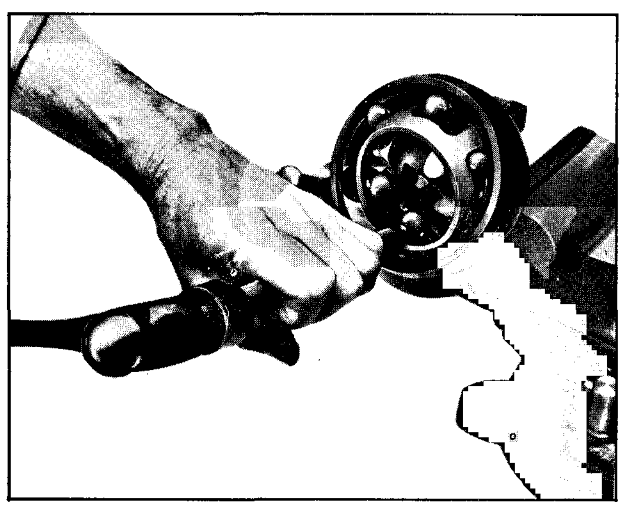


Fig. 3-73 Removing Balls From Outer Joint

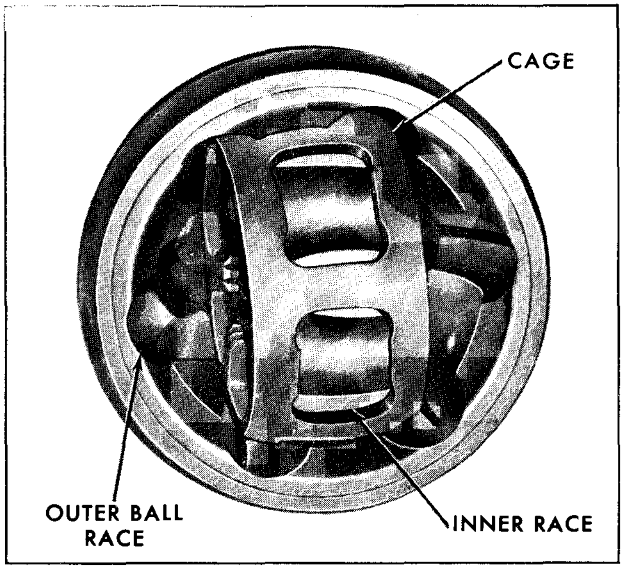


Fig. 3-74 Removing Cage And Inner Race

c. Assembly

1. Insert short land of inner race into slot in cage, and pivot to install in cage shown in Fig. 3-75.
2. Pack constant velocity joint with special drive axle joint lubricant, Part No. 105 0802, or equivalent.

(NOTE: One can of lubricant will service one complete drive axle joint only.)

3. Insert cage and inner race into outer race by aligning windows on cage with lands on outer race, Fig. 3-74. Pivot cage and inner race 90°.

(NOTE: Be certain that step on cage bore is positioned to inside of joint and snap ring groove on inner race is facing outside.)

4. Apply lubricant to the inner and outer race and insert balls into outer race one at a time until all six balls are installed. Inner race and cage will have to be tilted so that each ball can be inserted. Use of a hammer and brass drift may be helpful if a tight fit is encountered.
5. Position small end of seal in groove on axle shaft.

When installing outer joint seal on axle shaft, position small end of seal in outer groove in axle shaft, or groove nearest end of axle shaft, Fig. 3-76, and proceed as follows:

a. Loop seal clamp band around seal end twice with strap passing through its own retainer each time a loop is completed.

b. After completion of second loop, feed extra length of strap into small end of Seal Clamp Band Installer, J-22716. Be sure to have the open side of the tool facing up.

c. Slide bolt through holes in side of tool and, at the same time, secure strap in slot in the bolt.

d. Lift end of strap up and out of the open side of tool.

e. Place a wrench on bolt and draw band up tight, then torque bolt to 6-8 foot-pounds.

f. Rotate Seal Clamp Band Installer, J-22716, back over the band retainer.

g. Back tool off just enough to permit tapping band with a hammer until it lies flat across top of retainer. Tap the tabs down until they retain strap.

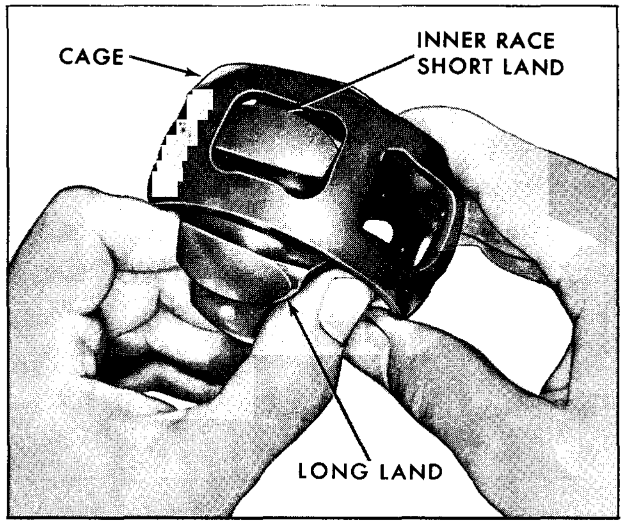


Fig. 3-75 Removing Inner Race From Cage

CAUTION: Tap lightly to avoid damaging seal.

h. Unwind the excess strap and cut it off close to retainer.

6. Pack inside of seal with approximately 1/4 pound of special drive axle joint lubricant, Part No. 105 0802, or equivalent.
7. Install snap ring into inner race as shown in Fig. 3-72.
8. Insert axle shaft into splines of outer constant velocity joint until snap ring secures shaft in second snap ring groove.

(NOTE: Snap ring must be spread to facilitate mating of axle shaft into splines of outer constant velocity joint.)

9. Position seal in groove of outer race.

(NOTE: Mating area of seal and outer race must be free of lubricant to obtain proper sealing.)

10. Install large seal clamp band over seal and install band.

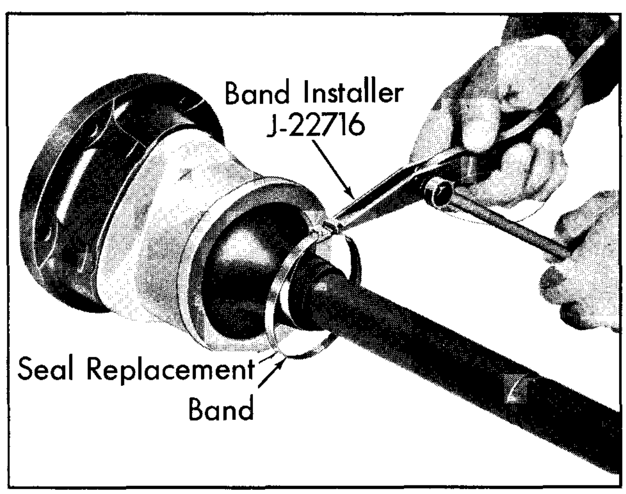


Fig. 3-76 Positioning Seal Clamp Band On Seal

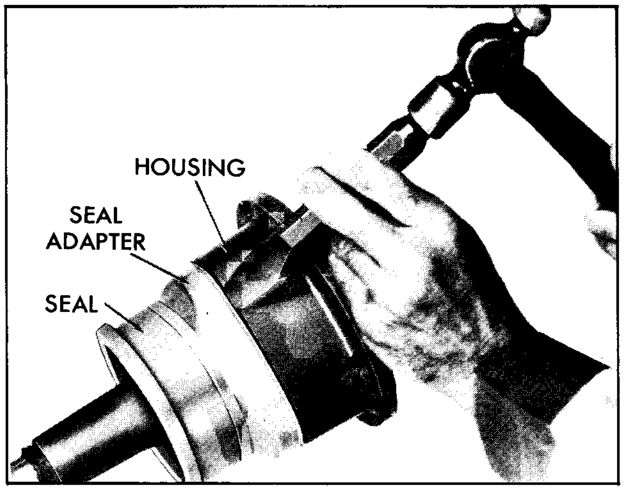


Fig. 3-77 Removing Seal Adapter From Joint Housing

37. Inner Joint

a. Disassembly

1. With axle assembly lying on a bench, pry up staked areas on seal retainer and drive off housing with hammer and chisel, Fig. 3-77.
2. Grasp axle assembly with one hand and joint housing with the other and stand both vertically on bench. Carefully withdraw axle from housing, being certain not to lose balls and needles from axle.

(NOTE: It may be helpful to place a rubber band over ends of spider to retain the three balls and needle bearings. Wipe all excess grease from joint. Set housing aside.)

3. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

CAUTION: Be careful when clamping to avoid damage to axle.

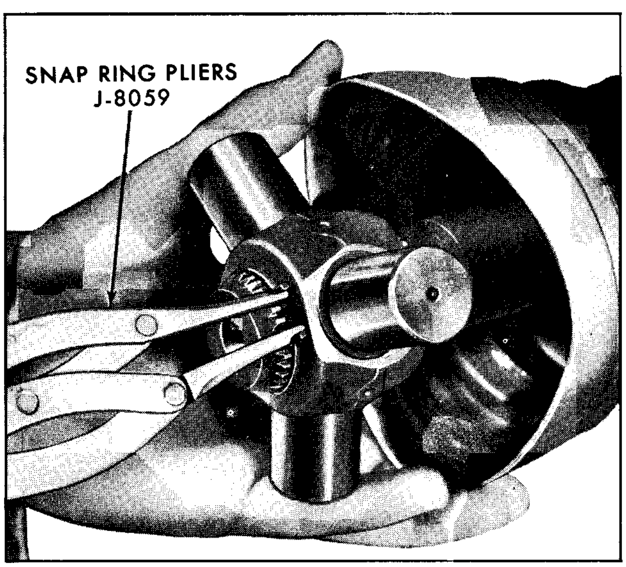


Fig. 3-78 Removing Spider Snap Ring

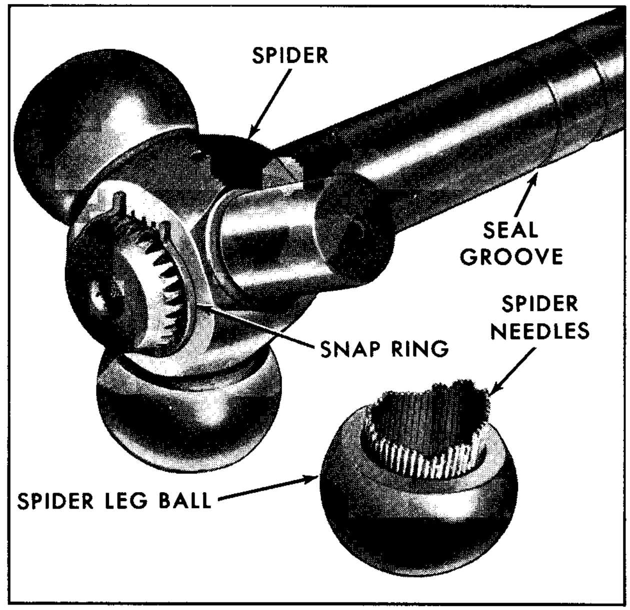


Fig. 3-79 Spider Assembly

4. Remove snap ring from end of axle shaft, Fig. 3-78.
5. Slide spider assembly, Fig. 3-79, from axle shaft.
6. Remove inner snap ring from axle shaft.
7. Remove small seal clamp.
8. Slide boot seal off axle shaft.
9. Remove three balls from spider, being careful not to lose any of the 53 needle bearings in each of the balls.
10. If necessary to remove tri-pot housing end cover or O-ring, proceed as follows:
    a. Secure housing in vise.
    b. Place a block of wood (approximately 2" x 2" x 8") in housing.
    c. Drive on wood block to push end cover out of housing.
    d. Remove housing O-ring and discard O-ring.

b. Cleaning and Inspection (Inner Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seal and O-rings for damage or wear. If seal or O-rings are damaged or worn, replace with new seal or O-rings.

1. Inspect seal adapter band for bent or cracked condition.
2. Inspect tri-pot housing for excessive wear and brinelling.

(NOTE: Housing may show a definite polished area where the balls travel but joint need not be replaced. However, if this wear pattern is suspected to be the cause of noise or vibration complaint, replace joint.)

3. Inspect snap rings for distortion or damage.
4. Inspect spider leg balls for excessive wear, cracks, nicks, scores, or breaks.
5. Inspect spider leg ball needles for chips, breaks, or bends.
6. Inspect spider for excessive wear, scores, or cracks.

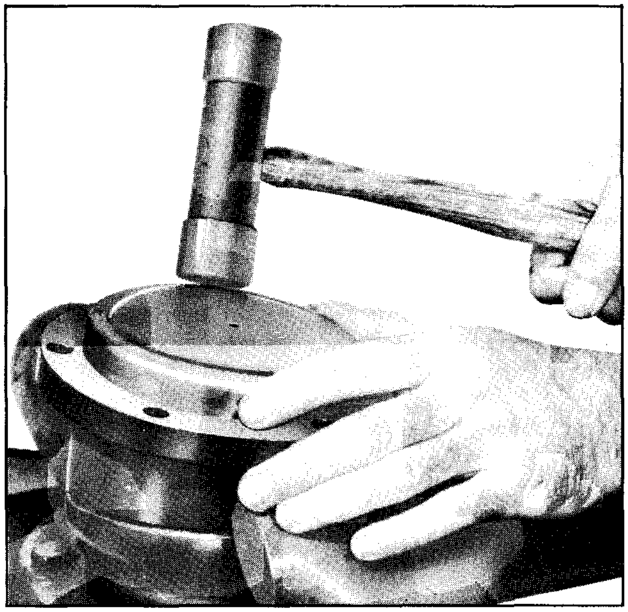


Fig. 3-80 Installing Tri-Pot Housing End Cover

c. Assembly

1. Slide new clamp onto axle shaft to be used after seal positioning.
2. Slide seal onto axle shaft.
3. Install inner snap ring on axle shaft.
4. If spider needles were removed, load 53 needles into each ball, lubricating with special drive axle lubricant, Part No. 105 0802, or equivalent.
5. Carefully install balls on each of the spider journals.

(NOTE: A rubber band may be used to retain balls in position until spider assembly is installed in housing.)

6. Position spider assembly on axle shaft and retain with outer snap ring.
7. If end cover and O-ring were removed, install new O-ring in housing, lubricate O-ring and install cover by tapping around outer edge of cover, Fig. 3-80.
8. Install O-ring in outer groove in housing.
9. Pack housing approximately one-half full with lubricant.
10. Remove rubber band, if used, from spider assembly.
11. Position spider assembly in line with housing assembly and push into housing until bottomed.
12. Fill housing with remainder of lubricant.
13. Swab inside of boot seal retainer and housing outer groove O-ring with lubricant.

CAUTION: Be careful that seal retainer is positioned so that O-ring is not cut.

14. With housing positioned as shown in Fig. 3-81. tap seal retainer on three lobes alternately with plastic hammer as shown until firmly bottomed, then stake three places into staking groove.
15. Extend inboard joint to maximum length and position seal into furthest groove from joint in axle.
16. Install seal clamp band on small end of seal, Fig. 3-81. Proceed as follows:

a. Loop seal clamp band around seal twice with strap passing through its own retainer each time a loop is completed, Fig. 3-76.

b. After completion of second loop, feed extra length of strap into small end of Seal Clamp Band Installer, J-22716.

(NOTE: Be sure to have the open side of the tool facing up.)

c. Slide bolt through holes in side of tool and at same time secure strap in slot in the bolt.

d. Lift strap up and out of open side of tool.

e. Place a wrench on bolt and draw band up tight, then torque bolts to 6-8 foot-pounds.

f. Rotate Seal Clamp Band Installer, J-22716, back over band retainer.

g. Back tool off just enough to permit tapping band with a hammer until it lies flat across top of retainer. Tap tabs down until they retain strap.

h. Unwind excess strap and cut it off close to retainer.

38. Right Output Shaft Bearing

a. Removal

1. Remove output shaft as described in Note 34a, Steps 1 through 10.
2. Remove three self-tapping screws securing output shaft bearing retainer to support.
3. Make two steel plates 1/4" x 3" x 8" and install in a vise as shown in Fig. 3-82.

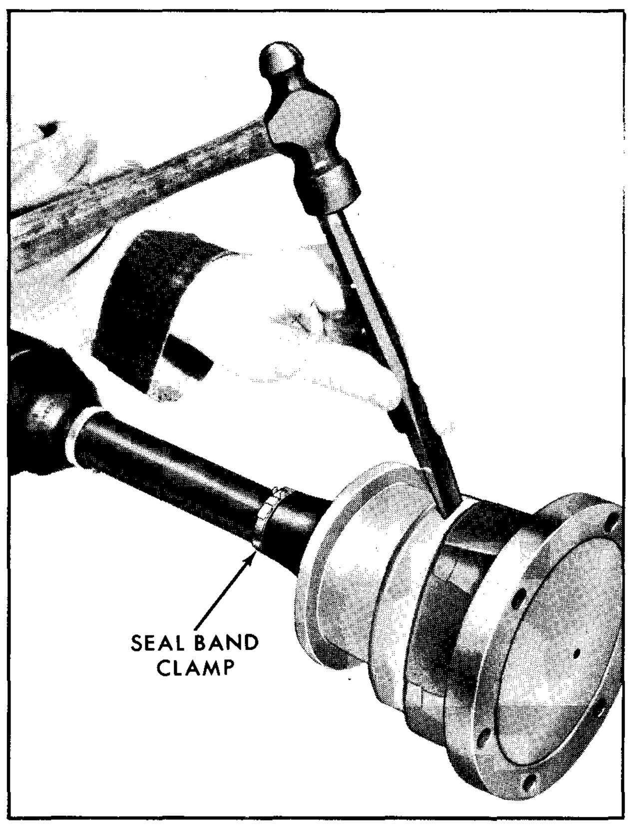


Fig. 3-81 Installing Seal Adapter On Joint Housing

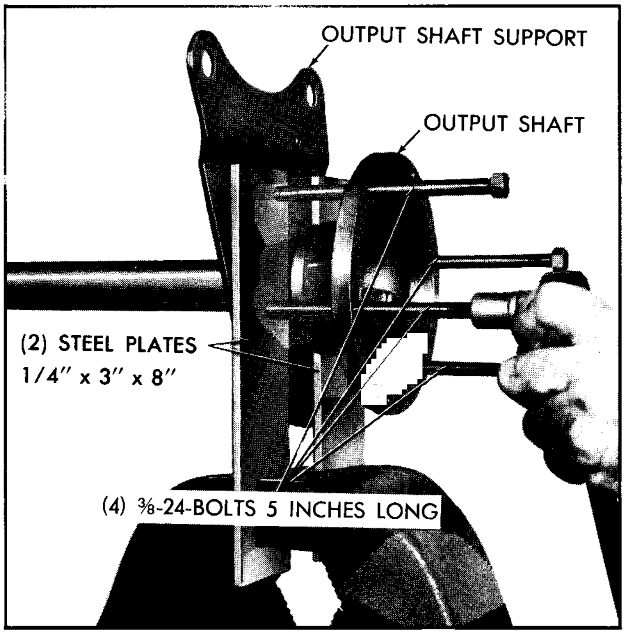


Fig. 3-82 Removing Right Outer Shaft Support And Bearing

4. Install four 3/8"-24 bolts (five inches long) on output shaft and install output shaft between steel plates in vise as shown in Fig. 3-82.

CAUTION: Use extreme care to prevent damage to seal surface on output shaft.

5. Remove bearing assembly by tightening bolts alternately.

b. Installation

1. Position output shaft on flange end on a work bench, Fig. 3-83.
2. Lubricate output shaft support and install over splined end of output shaft.
3. Lubricate bearing and install, using a hammer and Bearing Installer, J-22828, Fig. 3-83.
4. Lubricate exposed face of bearing and install bearing retainer. Secure bearing retainer with three self-tapping screws.
5. Using a hammer and Bearing Installer, J-22828, install slinger as shown in Fig. 3-84.
6. Install output shaft as described in Note 34b, beginning with Step 3.

39. Output Shaft Seal Replacement

a. Removal

1. To replace right output shaft seal, remove right output shaft as described in Note 34a. Steps 1 through 10. Then remove seal from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

2. To replace left output shaft seal, remove left output shaft as described in Note 35a. Then remove seal

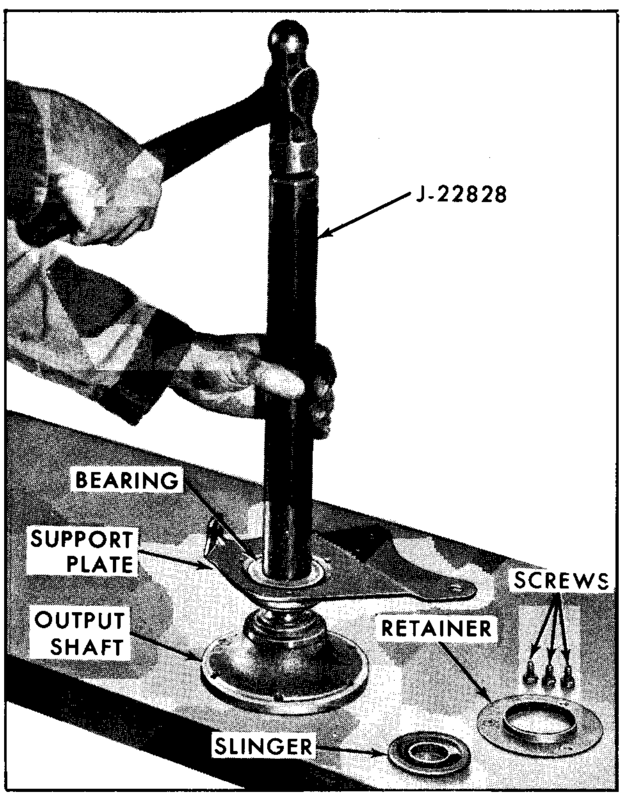


Fig. 3-83 Installing Right Outer Shaft Support And Bearing

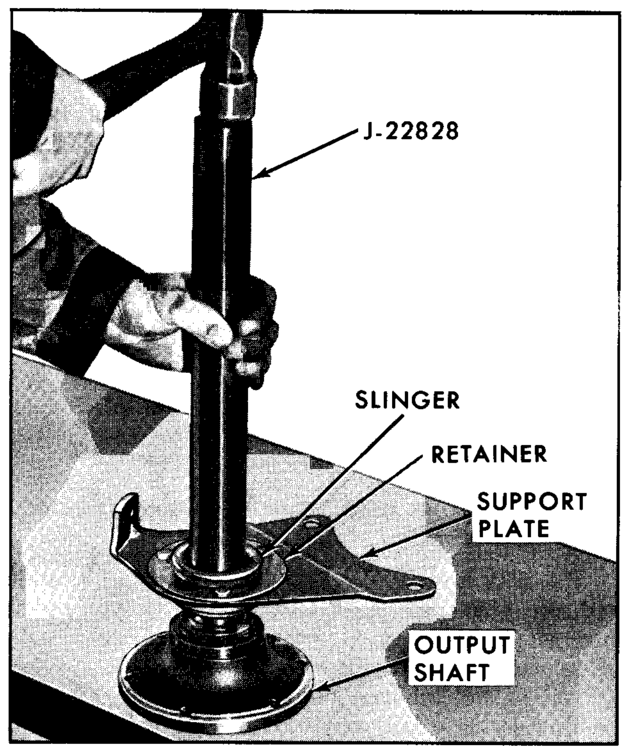


Fig. 3-84 Installing Right Output Shaft Support Slinger

from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

b. Installation

1. To install right hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22760. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed. Apply clean front wheel bearing grease between lips of seal.

CAUTION: Rotate tools to maintain proper alignment when installing seal.

2. Install right hand output shaft as described in Note 35b, beginning with Step 3.
3. To install left hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22199. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed.

(NOTE: The left hand output shaft seal contains a hole for venting the final drive unit. The top of the seal is identified by the word "Top" and must be installed with the word "Top" positioned up so that vent will be in proper position.)

4. Install left hand output shaft as described in Note 35b.

40. Final Drive

a. Removal

1. Raise hood and disconnect negative battery cable.
2. Remove bolt securing transmission filler tube bracket to final drive bracket and remove transmission filler tube.

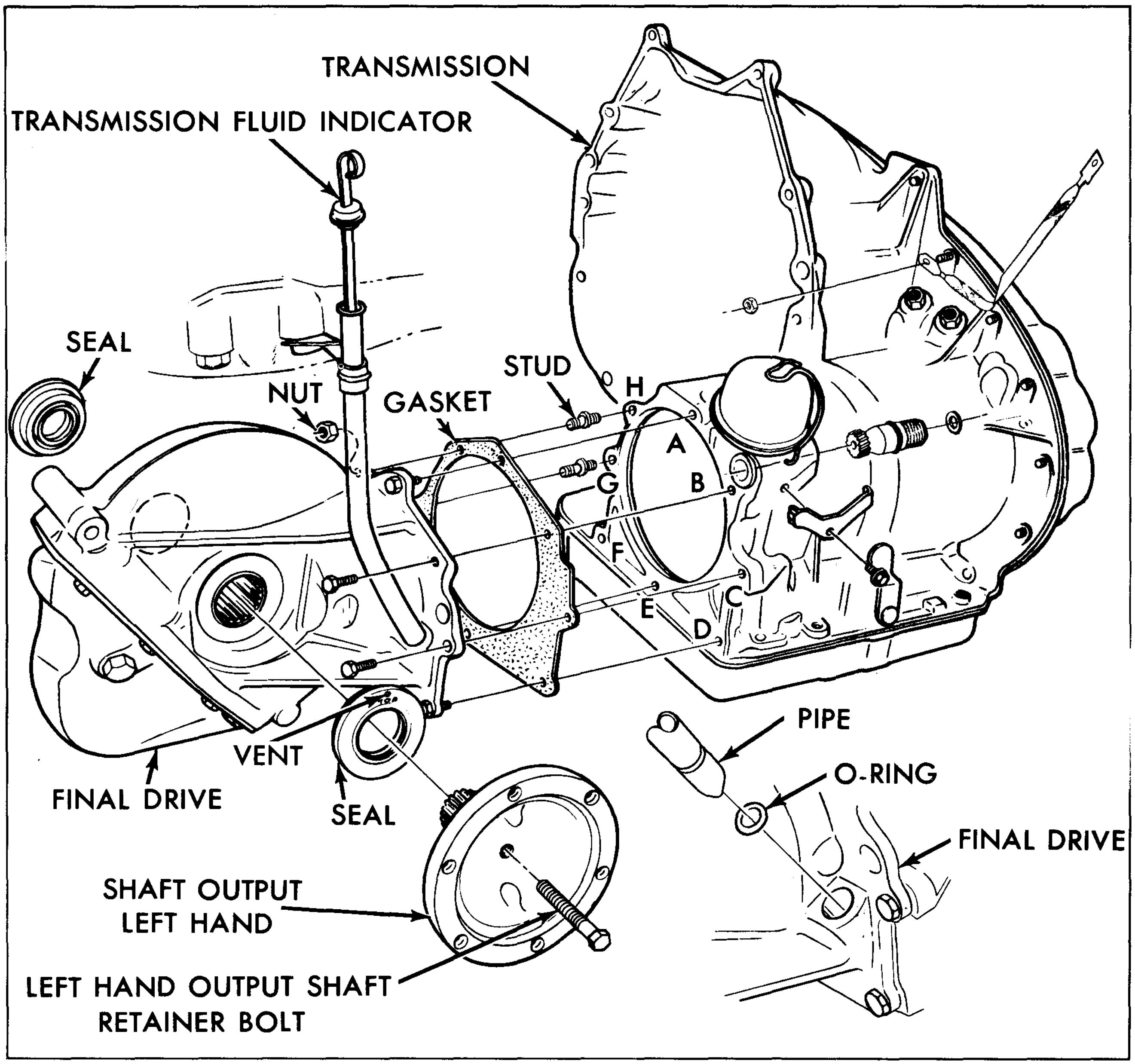


Fig. 3-85 Final Drive Attachment

3. Remove screws "A" and "B" and nut "H" securing upper part of final drive housing to transmission housing. Fig. 3-85.

(NOTE: The use of a box end wrench with a crescent-shaped handle, such as a starter and manifold wrench, will facilitate removal of nut "H".)

4. Remove self-tapping screw securing transmission cooler lines and clip to final drive support bracket, Fig. 3-86, and slide clip out of way.

5. Remove locknut, washer, and long bolt securing final drive support brace to engine mount bracket, Fig. 3-86. (Use a second wrench to hold locknut in place while turning bolt.)

6. Remove right output shaft, following Note 34a. Steps 3 through 10.

7. WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS ON THE ELDORADO FRONT SUSPENSION. BEFORE PERFORMING THE FOLLOWING STEP, BE CERTAIN THAT RIGHT SHOCK ABSORBER LOWER SLEEVE CANNOT BE DISLODGED FROM MOUNTING STUD. REMOVING THE SHOCK FROM THE LOWER MOUNT MAY ALLOW THE LOWER CONTROL ARM TO DROP DOWN.

Place jack stands under front frame side rails. Lower hoist and move hoist equipment away from work area.

8. Place a drain pan under final drive cover. Loosen ten final drive cover screws and pull cover away from housing. Allow lubricant to drain while performing next four steps.

9. Remove six screws securing left drive axle to output shaft. Compress drive axle inner constant velocity joint and secure in this position to permit clearance for removal of final drive unit with left output shaft installed.

10. Remove bolt, washer, and nut securing left tie strut to frame cross member, loosen bolt securing strut to side rail, and rotate strut outboard until clear of final drive area.

11. Remove large through bolt, nut, and washers securing final drive support bracket to final drive. (Use a second wrench to hold nut stationary while turning bolt, Figs. 3-86 and 3-87.)

12. Remove final drive support bracket by lifting upward and outward.

13. Remove ten final drive cover screws and remove cover and cover gaskets.

14. The final drive assembly should be removed and installed with a transmission lift and a special adapter. Adapters are available commercially through lift equipment manufacturers. One such mechanism is shown in Fig. 3-88. All such adapters feature pivot points to provide a safe means of rotating the unit during lifting and lowering. Consult the instructions and recommendations of the manufacturer.

WARNING: TO AVOID PERSONAL INJURY, BE ABSOLUTELY CERTAIN THAT LIFT EQUIPMENT INDEPENDENTLY SUPPORTS AND HOLDS FINAL DRIVE UNIT BEFORE PERFORMING THIS STEP.

Place a drain pan under transmission and remove screws "C", "D", "E", and "F" and nut "G", Fig-85.

15. Disengage final drive splines from transmission, Fig. 388, and allow unit to drain.

16. Remove final drive unit from underside of car by sliding unit toward front of car, permitting ring gear to rotate over steering linkage, and lowering housing from car.

17. Remove and discard final drive to transmission gasket.

b. Installation

1. Apply transmission fluid to transmission side of new gasket and place gasket on studs.

2. Attach final drive unit securely to transmission jack adapter. Lift unit to on-car position, aligning unit with two studs and aligning final drive and transmission splines, Fig. 3-88.

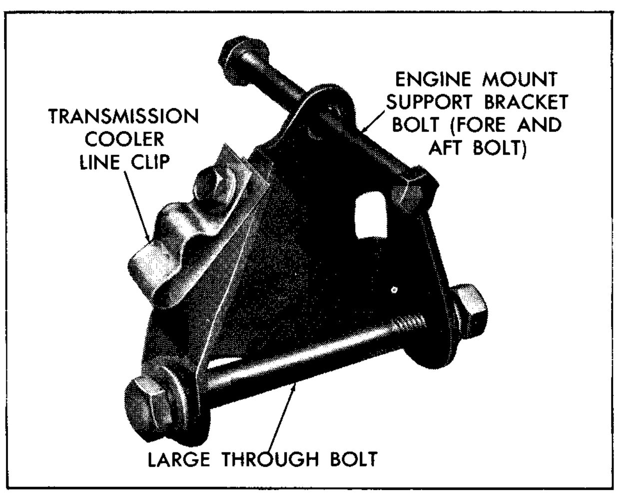


Fig. 3-86 Final Drive Support Bracket And All Fasteners

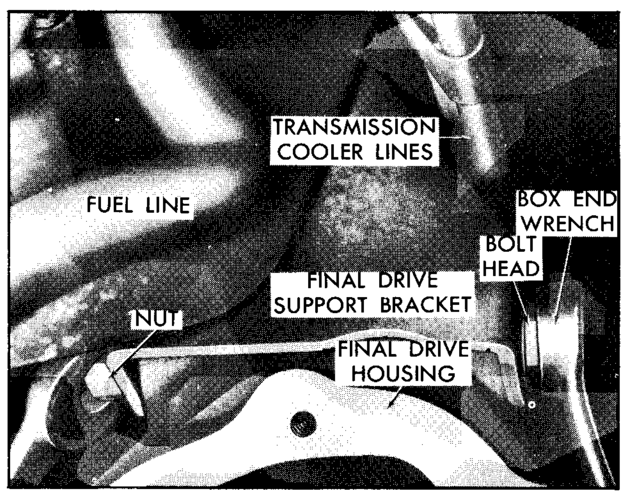


Fig. 3-87 Removing And Installing Large Through Bolt

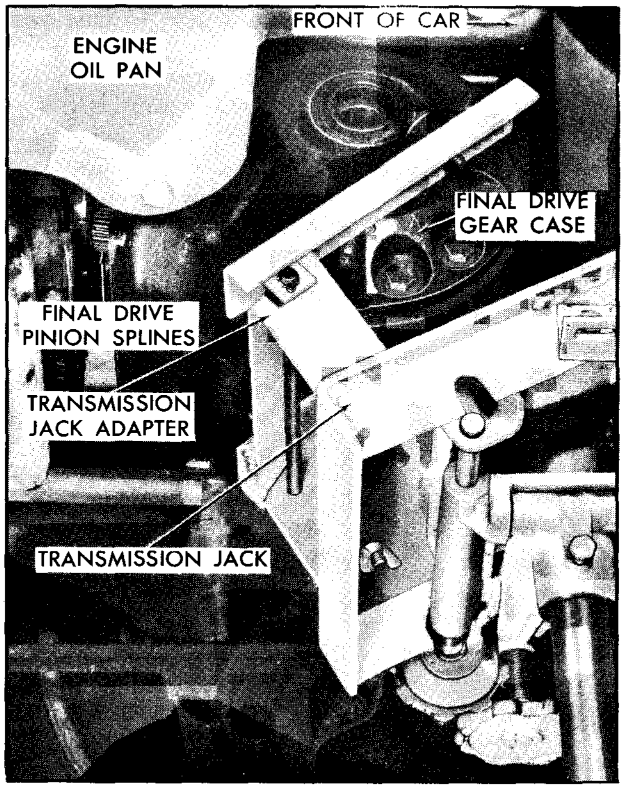


Fig. 3-88 Removing And Installing Final Drive

(NOTE: If splines do not line up, rotate left output shaft until splines can be engaged. Do not allow gasket to become mispositioned.)

3. Insert final drive support bracket as near as possible to proper installed position.

4. Insert large through bolt, nut, and washers and tighten with fingers, Fig. 3-86. Insert long bolt, washer, and locknut securing final drive support bracket to engine mount support and tighten with fingers. (If this "fore and aft" bolt cannot be installed, perform step 5; then insert bolt and proceed to step 6.)

5. Install screws "C", "D", "E", and "F" and nut "G"; tighten to 25 foot-pounds, Fig. 3-85.

6. Tighten large through bolt to 70 foot-pounds. (This torque is to be applied to head of bolt while nut is held, Fig. 3-87.)

7. Remove transmission jack and adapter assembly from final drive housing and remove assembly from work area.

8. Install final drive cover and new cover gaskets, tightening ten screws to 156 inch-pounds.

(NOTE: Two gaskets are used at the final drive cover to provide a vent for the unit. Thin, dark gray gasket must be installed next to housing, with slotted, light gray gasket on top–next to cover–for vent to be effective.)

9. Position left drive axle on output shaft and fasten with six screws, tightening to 65 foot-pounds.

(NOTE: Have a helper apply brakes to prevent axle from turning while tightening screws.)

10. Remove rubber hose previously installed on left torsion bar connector.

11. Install left tie strut on frame cross member, securing with bolt, nut, and washer. Tighten tie strut fastener at frame side rail.

12. Install right output shaft, support, and strut as an assembly, employing technique described in Note 34b, Steps 3 through 8.

13. Fill final drive unit with lubricant until within 1/2" of filler hole.

14. Lower car.

15. Tighten long bolt and locknut securing final drive support bracket to engine mount support to 20 foot-pounds, Fig. 3-86. (This torque is to be applied to locknut while holding bolt stationary.)

16. Install screws "A" and "B" and nut "H" securing upper part of final drive housing to transmission. Tighten to 25 foot-pounds, Fig. 3-85.

17. Install a new O-ring on transmission filler tube, Fig. 3-85.

18. Remove plug and install transmission filler tube, securing to exhaust manifold.

19. Slide transmission cooler line clip into place and secure clip to final drive support bracket with one screw, Fig. 3-86, tightening to 96 inch-pounds.

20. Connect negative battery cable.

21. Check engine oil level, start engine, and check transmission fluid level. Add fluid as required.

22. Check output shaft seals, final drive to transmission connection, and final drive cover for oil leaks.

41. Pinion Bearing Oil Seal Replacement

a. Removal

1. Remove final drive unit from car as described in Note 40a.

2. Working on bench, remove six pinion bearing housing to final drive case bolts.

3. Remove pinion bearing housing by applying a steady pull on splined end of pinion gear with one hand and gently rotating pinion bearing housing with other hand.

4. Remove pinion bearing housing O-ring and discard.

5. Inspect vent pin O-ring seal and replace if necessary.

6. Drive pinion gear oil seals from pinion bearing housing with a screwdriver.

CAUTION: Use extreme care to prevent damage to pinion bearing housing oil seal surface.

b. Installation

1. Place pinion gear oil seals back to back with spring on seals exposed.

2. Install oil seals on Seal Installer, J-22212.

3. Drive on Seal Installer, J-22212, until tool bottoms against housing.

4. Install a new pinion bearing O-ring in final drive case.

5. Install pinion gear in final drive case.

6. Install Seal Protector, J-22236, over splined end of pinion gear.

7. Install pinion bearing housing over pinion gear. Gently rotate pinion bearing housing until properly seated in final drive case.

8. Install six pinion bearing housing to final drive case bolts. Tighten bolts to 35 foot-pounds.

9. Remove Seal Protector, J-22236.

10. Install final drive unit in car as described in Note 40b.

TORQUE SPECIFICATIONS (ELDORADO ONLY)

Material No.	Application	Thread Size	Foot-Pounds
286-M	Drive Axle Nut	1"-20	See Below**
GM 6010-M	Stabilizer Bracket to Frame Screw	3/8-16	35
301-M	Shock Absorber (upper) Nut	9/16-12	75
301-M	Shock Absorber (lower) Nut	9/16-12	75
300-M	Lower Control Arm Bushing Bolts	1/2-13	80*
300-M	Upper Control Arm Bushing Bolts	1/2-20	95*
301-M	Lower Spherical Joint Nut	9/16-18	80*
301-M	Upper Spherical Joint Nut	1/2-20	60*
286-M	Tie-Rod to Knuckle Nut	1/2-20	40*
300-M	Drive Axle to Output Shaft Screw	3/8-20	65
275-M	Output Shaft Support to Engine Block Screw	7/16-14	50
300-M	Left Hand Output Shaft Retainer Bolt	3/8-24	40
280-M	Bearing Retainer to Knuckle Screw	3/8-16	30
301-M	Final Drive Support Bracket to Engine Mount Support Nut	1/2-13	20
301-M	Upper Control Arm Spherical Joint to Arm Nut	5/16-18	25*
300-M	Final Drive Support Bracket to Final Drive Bolt	1/2-13	70
300-M	Final Drive to Transmission	3/8-16	25
301-M	Nut - Upper Control Arm Cam to Frame	1/2-20	95*
286-M	Tie Rod Adjuster Clamp Nut	3/8-24	22
286-M	Wheel Mounting Nuts	1/2-20	130*
			Inch-Pounds
GM 601	Transmission Cooler Line Clip to Final Drive Support Bracket Screw	5/16-12	96
GM 6010-M	Output Shaft Support to Brace Screw	5/16-18	144
GM 6010-M	Output Shaft Support Brace to Final Drive Screw	5/16-18	144
275-M	Final Drive Cover Screws	5/16-18	156
GM 6010-M	Bearing Retainer to Support Plate Screw	5/16-18	144
280-M	Torsion Bar Crossmember Bolt Nuts	5/16-18	120
SAE 1020-1022	Stabilizer Link Bolt Nuts	5/16-18	156
(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.)			

**After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to insert cotter pin.

CAUTION: These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

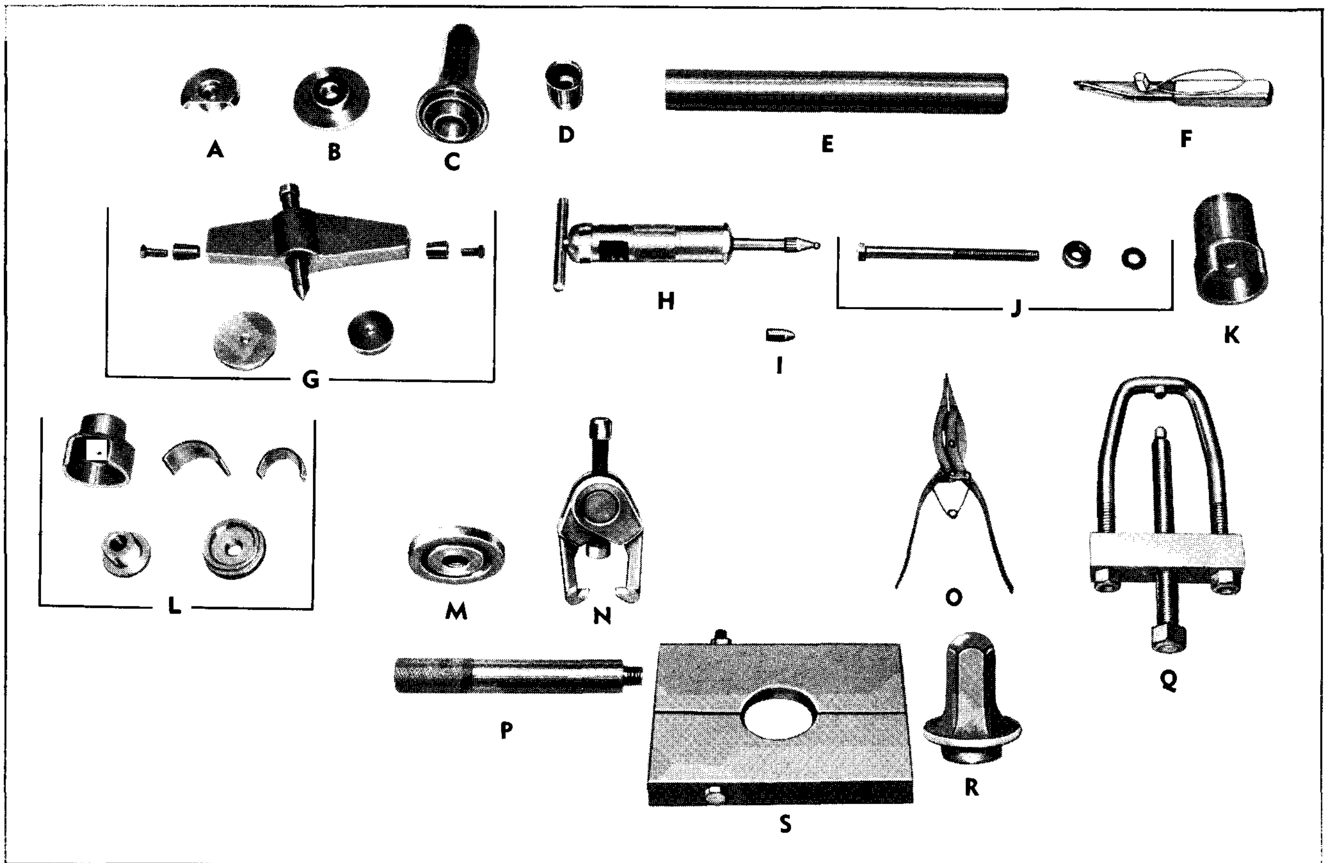


Fig. 3-89 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22760	Right Output Shaft Seal Installer	L	J-22222	Bushing Remover and Installer Set
B	J-22199	Left Output Shaft Seal Installer	M	J-23114	Front Knuckle Outer Seal Installer
C	J-22212	Pinion Oil Seal Installer	N	J-24319	Front Suspension Puller
D	J-22236	Pinion Oil Seal Protector	O	J-8059	Snap Ring Pliers
E	J-22828	Output Shaft Bearing Installer	P	J-8092	Universal Handle
			Q	J-22517	Torsion Bar Remover and Installer
F	J-22716	Band Installer			
G	J-22214	Knuckle and Bearing Remover	R	J-23115	Front Knuckle Inner Seal Installer
H	J-9280	Lubrication Gun	S	J-23997	Bearing Remover Press Plate
I	J-9280-5	Adapter Tip			
J	J-21474-3	Screw Assembly			
K	J-21474-5	Bushing Remover and Installer			

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GENERAL DESCRIPTION

A four link rear suspension system, Fig. 4-1, consisting of two upper and two lower control arms, steel coil springs, and shock absorbers is used on all conventional drive cars except the Commercial Chassis. The heavier Commercial Chassis uses semi-elliptical multiple leaf rear springs.

Two upper control arms are attached at their rear ends to inboard brackets on the rear axle housing and at their front ends to brackets on the rear suspension cross member. Two lower control arms are attached at their rear ends to outboard brackets on the rear axle housing and on their front ends to brackets on the frame side rails.

The rear shock absorbers are mounted at their upper ends in frame brackets to the rear of the axle center line. The lower ends are attached to mounting brackets on the axle housing.

On cars equipped with Automatic Level Control, bumper height adjustment is automatic.

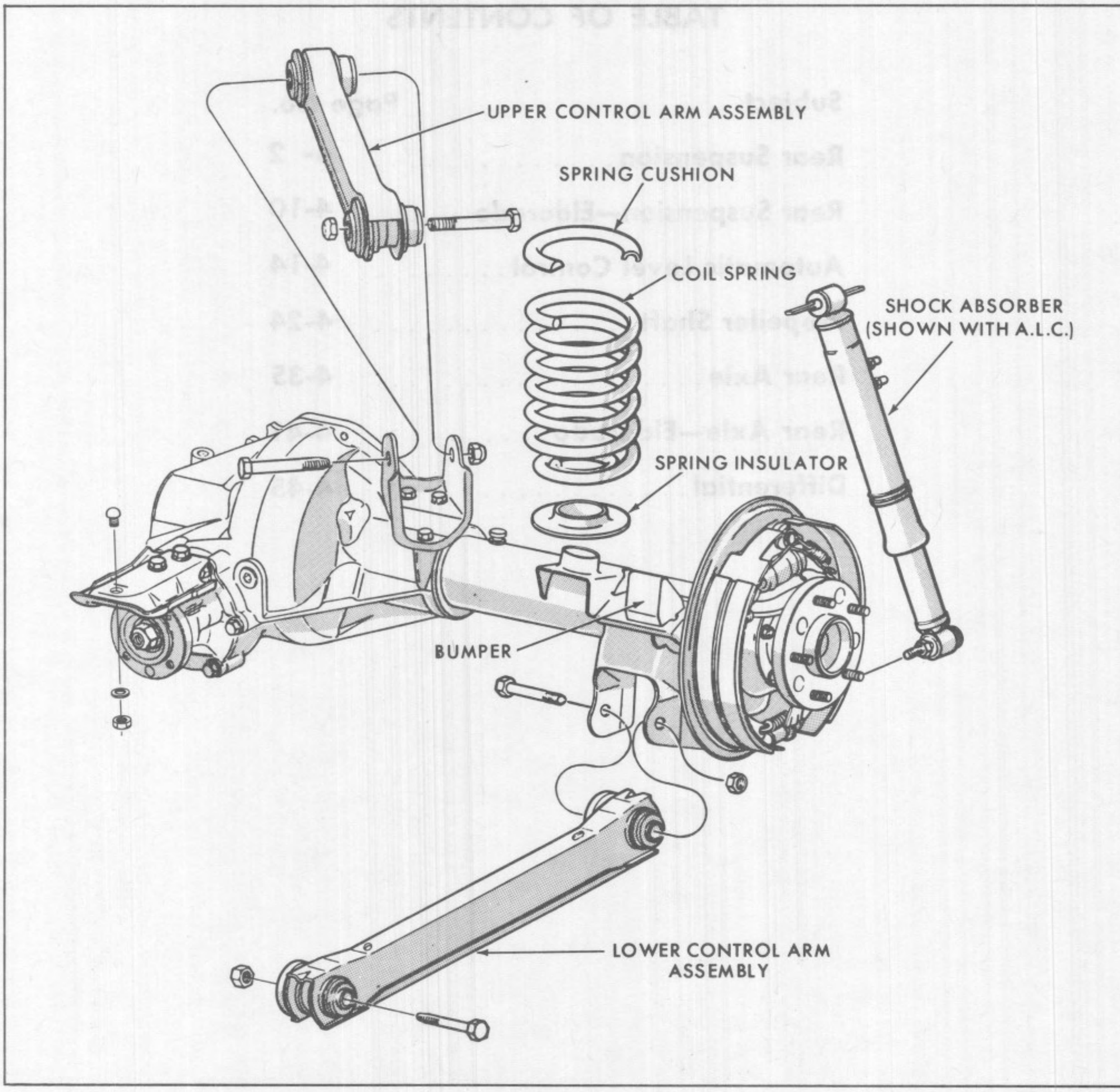


Fig. 4-1 Rear Suspension Disassembled

Rear Suspension System–Commercial Chassis Only

The rear springs are of the semi-elliptical multiple leaf type. They have seven leaves, 2-1/2 inches wide, with zinc inner liners between the first four leaves to provide correct interleaf friction and prevent corrosion. Tip liners are provided at the spring end for noise isolation and to further reduce friction. The spring eyes are cushioned at each end by rubber bushings and at the spring seats on the axle housing by rubber insulating pads.

Service information pertaining to the rear suspension system on the Eldorado is covered at the back of this section.

SERVICE INFORMATION—EXCEPT ELDORADO

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands as damage may result.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

The following caution applies to certain steps in the assembly procedure of components in this section. The critical fasteners to which this caution applies are identified by the terminology

See CAUTION on Page 4-3.

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Rear Standing Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack and that there is a full tank of gasoline, as all specifications are based on this observed weight. If car is equipped with Automatic Level Control, deflate system using service valve, then disconnect air line from superlift port on control valve. Deflation of the system is necessary when determining the standing height on the basis of springs alone When checking standing height to determine the proper functioning and adjustment of the Automatic Level Height Control Valve, the system must be connected and the reservoir charged with 100-140 psi. Normalize position of springs by bouncing bumper up and down, gradually reducing force applied, to permit car to assume its normal position.

a. Rear Springs

Measure distance from frame to axle, Fig. 4-3. Rear standing heights should be equal within 1/2 inch from side to side. Spring that checks below specifications must be replaced.

b. Ride Complaints

In case of hard riding, the first items to investigate are tire pressures, standing heights, and shock absorbers. If these are correct, the amount of friction in the rear suspension system should be checked.

The procedure for checking excessive friction in the rear suspension system is as follows:

1. Disconnect rear shock absorbers.
2. With aid of a helper, lift up on the rear bumper and raise car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height. Measure distance from floor to center of bumper.
3. The difference between the two measurements should be less than 1/2 inch. If the difference exceeds the limit, inspect the upper and lower control arms for damaged or worn parts.

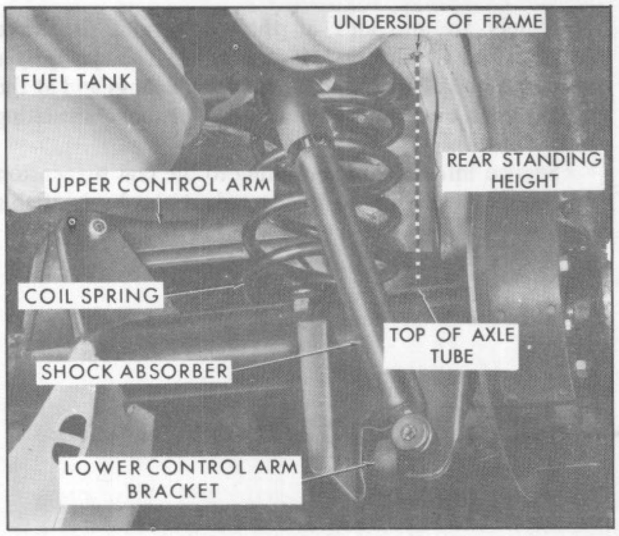


Fig. 4-3 Measuring Rear Standing Height

2. Rear Shock Absorbers

CAUTION: Be careful not to damage brake pipes or hoses throughout procedure.

a. Removal

1. Raise car so that both frame and axle are supported.
2. If car is equipped with Automatic Level Control, remove the air line fittings at shock absorbers.

WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS FOR THE REAR SUSPENSION. UNDER NO CIRCUMSTANCES SHOULD REAR END OF CAR EVER BE RAISED SO THAT REAR SUSPENSION IS IN REBOUND POSITION WHILE DISCONNECTING SHOCK ABSORBER UNLESS BOTH REAR AXLE AND FRAME ARE SUPPORTED, AS THIS COULD CAUSE INJURY OR DAMAGE.

3. Remove shock absorber upper retaining bolts and nuts. It may be necessary to fashion a simple tool for this operation. Bend a 1/2 inch box end wrench to a 45° angle at a point one inch from the center of the box end diameter, Fig. 4-4. Use this to hold each upper mounting nut at rear frame kick-up while removing mounting bolts.
4. Remove shock absorber lower retaining nut. It will be necessary to hold stem next to grommet to keep stem from turning, while removing nut with second wrench.
5. Remove shock absorber from its mounts.

b. Installation

1. On "C" cars, position the cross bar of the upper mount to the frame so that the shock angles naturally toward the lower mount. On commercial series, guide the upper shock absorber stem into mount. Install shock absorber upper attachment using special wrench used on removal.

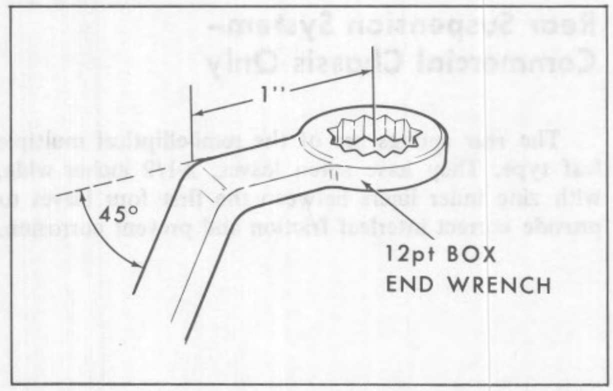


Fig. 4-4 Rear Shock Absorber Wrench

2. Install upper retaining nuts and bolts. Use special wrench used in Step 3a to hold nut while tightening bolt with a second wrench, tightening to 12 foot-pounds.
3. Guide shock absorber lower stud into mounting bracket and install retaining nut, tightening to 50 foot-pounds.
4. If car is equipped with Automatic Level Control, perform the following steps:

a. Install air line fittings at shock absorbers, tightening tube nuts to 30-40 inch pounds.

b. Inflate reservoir through service valve to 140 psi (or maximum pressure available).

c. Disconnect overtravel lever at axle bracket and push arm up, allowing air to enter superlift.

CAUTION: Do not put car weight on shock absorbers until they have been inflated as damage may result.

d. Return overtravel lever to normal position and reconnect arm to axle bracket.

5. Lower car.
6. If car is equipped with Automatic Level Control, check system for proper operation as described in Note 13.

3. Checking Rear Shock Absorbers

a. On Car Checks

1. Raise car on hoist.
2. Check for correct mounting of shock absorbers. If properly mounted, continue with next step.
3. Disconnect lower shock mount. Extend shock absorber and check to see if piston rod and seal (top of shock) cover is wet with a fresh film of oil. If oil is detected on rear shock absorber, remove the unit for bench check. (This check cannot be made on Automatic Level Control shock absorbers.)
4. If no oil is detected, pump shock absorber up and down by hand as fast as possible. If a skip is felt at end of stroke, remove shock absorber for bench check.
5. As another check, completely extend shock absorber and pull hard. If spring tension is felt, shock absorber should be replaced.

(NOTE: Pumping shock absorber by hand will not fully determine whether a shock absorber is good or bad. The best test method is to compare the questionable

shock absorber with its mate on opposite side of car; that is, a front with the other front, and rear with the other rear. If both shocks feel the same, it is unlikely that a shock absorber replacement is necessary. Bad shocks, as detected by this test, will affect ride motion only.)

b. On Bench Checks – Standard Shock Absorbers

1. When performing a bench check for any suspected shock absorber, clamp shock absorber upside down in a vise.

(NOTE: Cadillac standard shock absorbers can be turned upside down because all internal vapor (inert gas instead of air) is contained in a pliacell envelope which prevents aeration of oil and prevents lag. If a lag is noticed when stroked, it means the pliacell envelope has been ruptured and the shock should be replaced.)

2. Pump shock absorber by hand at various rates of speed to find if shock absorber is defective. If a skip is felt at full extension when the shock is inverted, this is normal. A skip on reversal of direction in mid-travel indicates a ruptured pliacell envelope. If smooth resistance is felt throughout length of the stroke, however, the shock absorber need not be replaced. A faint hiss ("orifice swish") is considered normal, but a gurgling noise denotes air bubbles in the fluid, and the shock absorber should be replaced.

c. On Bench Checks – Automatic Level Control Shock Absorbers

1. Clamp lower mounting ring in vise in vertical position.
2. Extend and collapse shock completely several times to discharge air out of the working chamber.
3. Pump unit by hand at different rates of speed. Smooth resistance should be felt throughout the length of the stroke. Since the shock absorber is normally pressurized, the sound of air bubbles or a gurgling noise is normal.

4. Rear Springs

a. Removal

1. Raise car so that both rear axle and frame are supported.
2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing attaching nut. Position overtravel lever in center position.

3. WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS ON THE REAR SUSPENSION SYSTEM. DO NOT PERFORM THIS STEP UNLESS BOTH AXLE AND FRAME ARE FIRMLY SUPPORTED AS INJURY OR DAMAGE COULD RESULT.

Remove both shock absorber lower retaining nuts and stems from mounts. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent the stem from turning, while removing retaining nut with a second wrench.

4. Place jack stand under pinion retainer to relieve tension on control arm bolts and remove bolts and nuts securing upper control arms to axle brackets.
5. Remove four screws and lockwashers securing propeller shaft rear flange to pinion flange and support propeller shaft with wire or fan belt, Fig. 4-27.
6. Remove jack stand from under pinion retainer.

7. WARNING: IF AXLE IS ALLOWED TO WIND UP AS IT IS LOWERED, SPRINGS MAY SNAP FROM THEIR SEATS AND COULD CAUSE INJURY OR DAMAGE. USE EXTREME CAUTION TO PREVENT WIND-UP CONDITION.

Lower axle slowly until brake hose loses almost all slack. Compress springs by hand if necessary to lift off seats, and remove springs from car.

CAUTION: Under no circumstances is the axle to be lowered to the point at which brake hoses become taut, as damage may result.

8. Inspect upper and lower spring insulators and replace if required.

b. Installation

1. Position lower rubber insulator on rear axle housing mount.
2. Tape upper rubber insulator to top of spring and position spring so that end of top of spring is properly aligned with recess in upper seat of frame tower. Spring position should be within limits shown in Fig. 4-5.
3. Seat bottom of spring on lower rubber insulator.
4. Raise rear axle on hoist and check spring position.
5. Install lower shock absorber stems in mounts.
6. Install one nut at each mount. Torque nuts to 50 foot-pounds.
7. Position rear upper control arms in axle brackets and secure each with one bolt and nut. Do not torque nuts at this time.
8. Raise rear axle to on-car position.

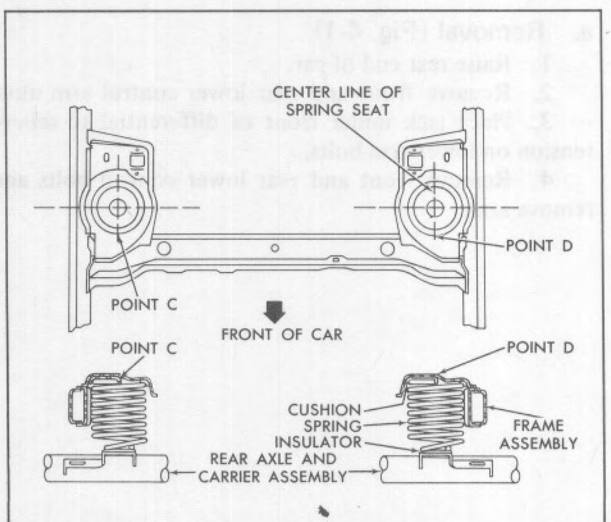


Fig. 4-5 Coil Spring Indexing

9. On cars equipped with Automatic Level Control, perform the following steps:

a. Install air line fittings at shock absorbers, tightening tube nuts to 30-40 inch-pounds.

b. Inflate reservoir to 140 psi (or maximum pressure available) through compressor service valve.

c. Lift overtravel lever allowing air to enter shock absorbers.

d. Release overtravel lever and secure to axle with one nut.

10. Secure propeller shaft rear flange to pinion flange with four screws and lockwashers, tightening to 70 foot-pounds.

See CAUTION on Page 4-3.

11. Remove jack stands and lower car. Vehicle is now at standing height.

12. Tighten upper control arm nuts to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolt and nut in control arms must be torqued when normal vehicle weight is applied to axle. If not, the ride may be adversely affected.

6. Rear Lower Control Arm

WARNING: IF BOTH CONTROL ARMS ARE TO BE REPLACED, REMOVE AND REPLACE ONE CONTROL ARM AT A TIME TO PREVENT THE AXLE FROM ROLLING OR SLIPPING SIDEWAYS AS THIS MIGHT OCCUR WITH BOTH UPPER CONTROL ARMS REMOVED MAKING REPLACEMENT DIFFICULT.

CAUTION: Be careful not to damage brake piping on axle housing throughout this procedure.

a. Removal (Fig. 4-1)

1. Raise rear end of car.
2. Remove front and rear lower control arm nuts.
3. Place jack under front of differential to relieve tension on lower arm bolts.
4. Remove front and rear lower control bolts and remove arm. (Neither front nor rear bushings in the lower control arms are serviceable.)

b. Installation

1. Slide lower control arm into position with the slotted hole in top of arm toward rear of car; flanged ends of bushings must face right side of car. Install front bolt from outboard side, and rear bolt from inboard side. Adjust jack under front of differential as necessary to install bolts.
2. Lower car.
3. Install front and rear lower control arm nuts, tightening to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must always be torqued when full normal load is applied to axle. If not, the ride rate may be adversely affected.

7. Rear Upper Control Arm

WARNING: IF BOTH CONTROL ARMS ARE TO BE REPLACED, REMOVE AND REPLACE ONE CONTROL ARM AT A TIME TO PREVENT THE AXLE FROM ROLLING OR SLIPPING SIDEWAYS AS THIS MIGHT OCCUR WITH BOTH UPPER CONTROL ARMS REMOVED, MAKING REPLACEMENT DIFFICULT.

a. Removal

1. Raise rear end of car.
2. If car is equipped with Automatic Level Control, remove attaching nut that secures height control valve link to left upper control arm. Position overtravel lever in center position.
3. Place jack stand under differential pinion retainer.
4. Remove both front and rear mounting nuts from control arm bolts.
5. Remove both control arm pivot bolts and remove control arm. (Neither front nor rear upper control arm bushings are serviceable.)

b. Installation

1. Install control arm with flanged surfaces of bushings inboard.
2. Loosely install front pivot bolt and nut.
3. Loosely install rear pivot bolt and nut in axle bracket.
4. Lower car.
5. Tighten front and rear nuts to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must always be torqued when full normal load is applied to axle. If not, the ride rate may be adversely affected.

6. If car is equipped with Automatic Level Control, secure link to left upper control arm with attaching nut. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

8. Rear Leaf Spring Liner Service—Commercial Chassis

Replacement rear spring liner tips are available for installation between the spring leaves when original liners wear at the outer ends.

To install these replacement liner tips, it is necessary to use a hardwood wedge 2-1/2 inches wide, 5 inches long, and tapered from 1/8 inch to 3/4 inch thick in 2 inches of length. Proceed as follows:

1. Remove spring rebound clips.
2. Raise rear of car until springs are in full rebound position.
3. Mark off length of replacement liner tip on main spring leaf, allowing 1/2 inch projection beyond second leaf.
4. After carefully placing a piece of sheet metal between liner and spring leaf to protect leaf, pry first and second leaf apart and insert wedge under liner just beyond old liner.

CAUTION: It is necessary to protect the spring leaf because a small nick in the leaf from a steel wedge could cause a point of fatigue that might result in spring failure. Use a hardwood wedge whenever possible.

5. Remove original liner.
6. Install new liner tip with button end toward axle. Work out wedge keeping liner tip in position.
7. Repeat above operation at each of the two upper liners in each rear spring.

9. Rear Leaf Spring—Commercial Chassis

a. Removal

1. Raise car so that weight of body is entirely off the spring and support axle housing with adjustable stands.
2. Remove front eye bolt nut and drive out eye bolt.
3. Disconnect shock absorber from U-bolt plate.
4. Remove rear shackle link nuts, Fig. 4-6.
5. Remove U-bolt nuts, washers, lower spring plate, lower insulator retainer, and insulator pad.
6. Remove spring from frame attachment by disconnecting rear shackle link assemblies.

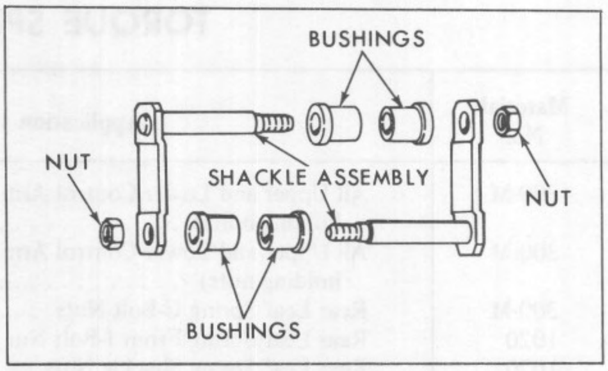


Fig. 4-6 Rear Leaf Spring Shackle

b. Installation

1. Install new bushings in spring eyes and in shackle-to-frame mounting sleeves.
2. Install shackle link on frame.
3. Install shackle link on spring and attach this assembly to shackle link on frame. Install nuts loosely.
4. Line up front spring eye on bracket on frame and install bolt from inner side of frame. Install nut, but do not tighten until car is lowered.
5. Install insulator pad and retainer on top of spring, with hole in pad and retainer over spring center bolt.
6. Position center of spring under rear axle housing bracket with spring center bolt located in hole provided in bracket.
7. Install insulator pad, retainer, and U-bolts; and install U-bolt nuts and lockwasher, torquing to 45 foot-pounds.

(NOTE: Lower car before tightening U-bolts or rear shackle nuts. This permits rubber bushings to take a neutral position and assures a more accurate torquing.)

8. Connect rear shock absorber at spring U-bolt plate.
9. Tighten front eye bolt and rear shackle link nuts to 70 foot-pounds.

See CAUTION on Page 4-3.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
300-M	All Upper and Lower Control Arm Nuts (while holding bolts)	1/2–13	75*
300-M	All Upper and Lower Control Arm Bolts (while holding nuts)	1/2–13	95*
300-M	Rear Leaf Spring U-Bolt Nuts	1/2–13	45
1020	Rear Leaf Spring Front I-Bolt Nut	1/2–20	45*
1020	Rear Leaf Spring Shackle Nuts	1/2–20	45*
275-M	Rear Shock Absorber Bolts (upper)	5/16–18	12
286-M	Rear Self Locking Shock Attaching Nut (lower)	1/2–20	50

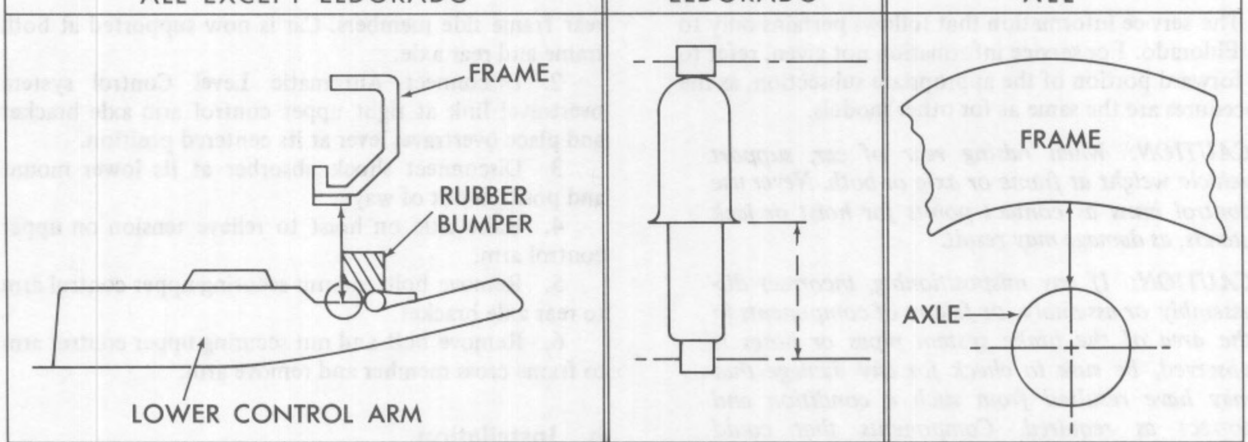
NOTE: Refer to back of Manual, Page 16-1 for Bolt and Nut Markings, and Steel Classifications.

**These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

VEHICLE STANDING HEIGHTS			
STYLE		FRONT STANDING HEIGHT (INCHES)	REAR STANDING HEIGHT (INCHES)
CALAIS COUPE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
CALAIS SEDAN	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
COUPE DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
SEDAN DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
FLEETWOOD BROUGHAM	STANDARD	3-7/8 TO 4-5/8	4-7/8 TO 5-5/8
FLEETWOOD 75 SEDAN	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
FLEETWOOD 75 LIMO	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
ELDORADO COUPE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16
ELDORADO CONVERTIBLE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16

CHECKING POINTS

ALL EXCEPT ELDORADO	ELDORADO	ALL



FRONT	REAR

(NOTE: On cars equipped with Automatic Level Control, first determine if the unit is working. Place weight of one man on rear bumper. Rear of car should lower and then raise after 4 to 18 seconds. If system is inoperative, see Note 16, Compressor Output Test and Note 17, Control Valve Test.)

*Springs can settle up to 3/8" during first 2500 vehicle miles. The values in this chart are for vehicles with settled springs. On new vehicles, add 3/8" to measurements given.

GENERAL DESCRIPTION

(NOTE: The following information is applicable only to the Eldorado.)

A four link, coil spring rear suspension system is used on Eldorado series cars Fig. 4-7. It consists of two upper and lower control arms, coil springs, stabilizer bar, and Automatic Level Control shock absorbers.

Automatic Level Control is provided as standard equipment on the Eldorado and functions the same as on other series cars. The height control valve is located on the right side of the frame cross member above the right upper control arm. Consequently, the right shock absorber has a double port, Fig. 4-13.

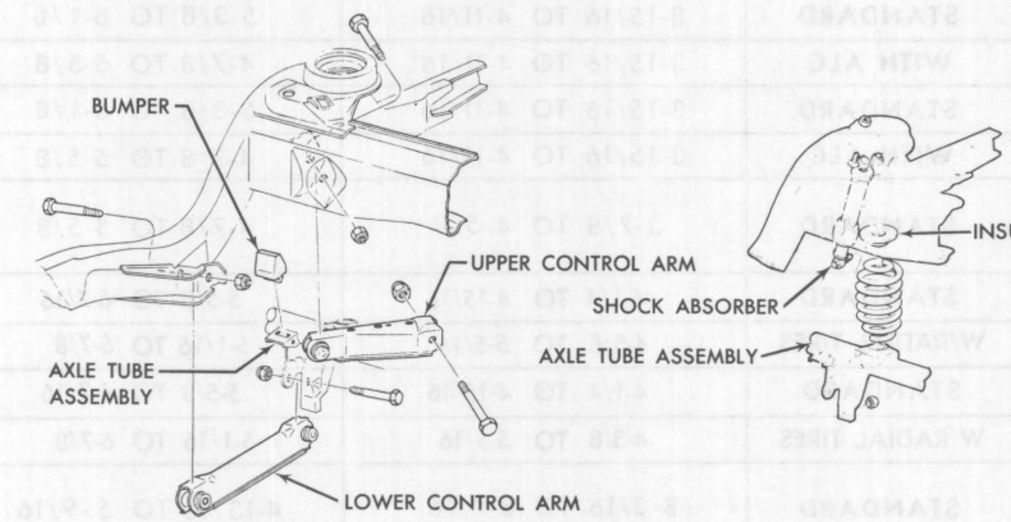


Fig. 4-7 Rear Suspension Disassembled – Eldorado

SERVICE INFORMATION

The service information that follows pertains only to the Eldorado. For service information not given, refer to the forward portion of the appropriate subsection, as the procedures are the same as for other models.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

CAUTION: If any mispositioning, incorrect disassembly or assembly, or failure of components in the area of the brake system pipes or hoses is observed, be sure to check for any damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect disassembly or assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

10. Rear Upper Control Arm

a. Removal

1. Raise car on hoist and position jack stands at rear frame side members. Car is now supported at both frame and rear axle.
2. Disconnect Automatic Level Control system overtravel link at right upper control arm axle bracket and place overtravel lever at its centered position.
3. Disconnect shock absorber at its lower mount and position out of way.
4. Raise axle on hoist to relieve tension on upper control arm.
5. Remove bolt and nut securing upper control arm to rear axle bracket.
6. Remove bolt and nut securing upper control arm to frame cross member and remove arm.

b. Installation

1. Install control arm in its mounting brackets.
2. Loosely install bolts and nuts securing control arm in mounting brackets, adjusting height of axle as necessary. (Do not torque bolts at this time.)
3. Guide shock absorber lower stem into lower mount, adjusting height of axle if necessary, and secure with retaining nut. Tighten to 50 foot-pounds.
4. Raise axle and remove jack stands.

(NOTE: When tightening nut and holding bolt, a

lower torque is used than when tightening bolt and holding nut.)

5. Torque upper control arm bolts while holding nuts, at frame cross member to 145 foot-pounds and torque upper control arm bolts at axle bracket to 110 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must be torqued when full normal load is on axle. If not, the ride rate may be adversely affected.

6. Secure Automatic Level Control overtravel lever to right upper control arm bracket with nut. Lower car. Inflate reservoir to 140 psi or maximum pressure available through service valve.

7. Inspect brake hose and lines for any damage that may have occurred during this operation, and repair as necessary.

11. Rear Upper Control Arm Bushing

Only the rear upper control arm rear bushings (those pressed into the axle bracket) are serviced separately. All other bushings in the Eldorado rear suspension are serviced only with their respective control arms, as assemblies.

a. Removal

1. Remove rear upper control arm as described in Note 9a, Steps 1 through 6.
2. Move control arm away from bushing.
3. Install tools as shown in Fig. 4-8, and press bushing from axle bracket.

b. Installation

1. Insert bushing into axle bracket with flanged side on outboard side of bracket.
2. Install tools as shown in Fig. 4-9, and press bushing into axle bracket.
3. Install upper control arm as described in Note 9b, Steps 2 through 7.
4. Lower car.

12. Rear Stabilizer Bar

a. Removal

1. Raise car and support frame forward of rear wheels.
2. Remove four bolts (two each side) securing stabilizer bar to brackets on lower control arm.
3. Remove stabilizer bar.

b. Installation

1. Position stabilizer bar to brackets on lower control arms.
2. Secure stabilizer bar with four bolts (two each side).
3. Lower car.

13. Lower Control Arm

a. Removal

1. Raise car on hoist.
2. Remove stabilizer bar as described in Note 12a.
3. Remove bolts and nuts securing lower control arm to axle and frame side member brackets and remove control arm.

b. Installation

1. Position lower control arm in frame side member and axle brackets and insert bolts and nuts. Do not torque at this time.
2. Inspect brake lines and hose for any damage that may have occurred during this operation, and repair as required.

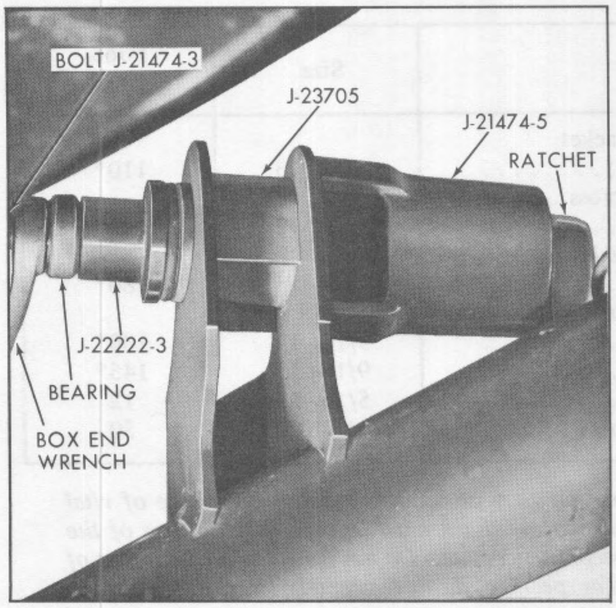


Fig. 4-8 Removing Upper Control Arm Bushing From Axle – Eldorado

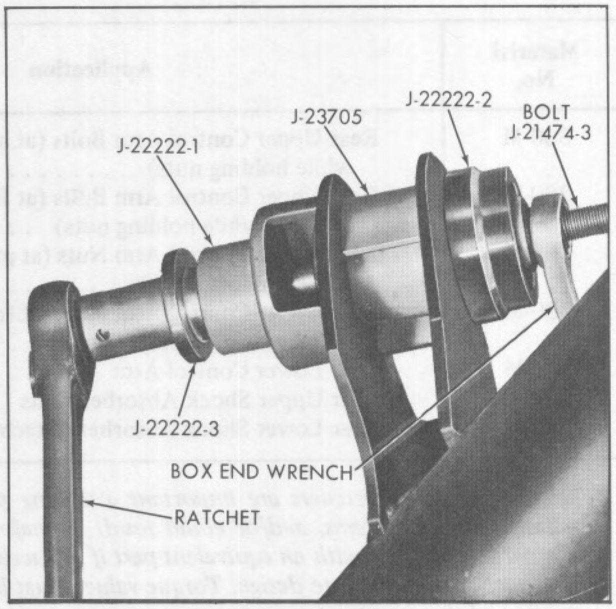


Fig. 4-9 Installing Upper Control Arm Bushing In Axle – Eldorado

3. Lower car.

4. Tighten control arm bolts to 145 foot-pounds while holding nuts stationary.

See CAUTION on Page 4-3.

5. Install stabilizer bar as described in Note 12b.

CAUTION: Pivot bolts in control arms must be torqued when axle is under normal load. If not, the ride rate may be adversely affected.

14. Rear Springs

a. Standing Height

Rear standing heights should be equal within 1/2 inch from side to side (see chart on Page 4-9.) If rear height is out of specified range, set front standing height to mean specification and recheck rear heights. Spring that checks below specification must be replaced.

b. Removal

1. Perform procedure in Note 9a to remove both rear upper control arms from axle brackets and to remove both shock absorbers from their lower mounts.

2. Disconnect brake hose and cap brake system to minimize leakage.

3. WARNING: IF AXLE IS LOWERED BEYOND FULL REBOUND POSITION, SPRINGS MAY SNAP FROM SPRING SEATS AND CAUSE INJURY OR DAMAGE. FOR THIS REASON, LOWER AXLE TO A POSITION JUST SHORT OF FULL REBOUND, THEN COMPRESS SPRING BY HAND AND REMOVE FROM SPRING SEATS.

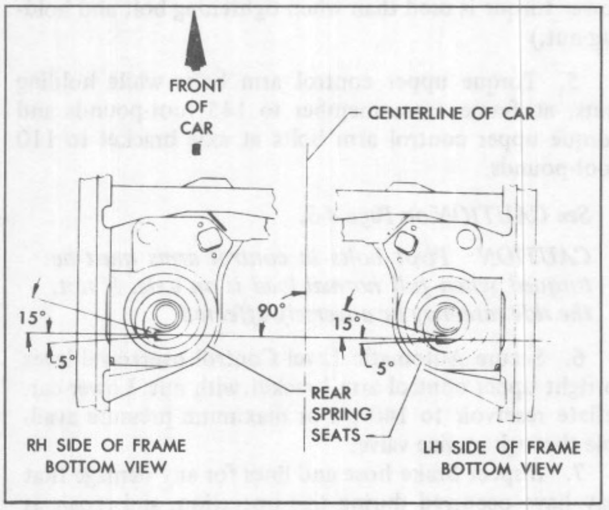


Fig. 4-10 Coil Spring Indexing – Eldorado

Lower axle carefully until springs can be removed manually.

b. Installation

1. Inspect rubber insulator in upper spring mounts for damage and proper position.

2. Insert springs and raise axle until springs are fully seated, and upper end of springs positioned within limits shown in Fig. 4-10.

3. Install upper control arms, shock absorbers, and connect Automatic Level Control, as described in Note 10b, Steps 1 through 6.

4. Connect brake hose and bleed brakes as described in Section 5, Note 6.

TORQUE SPECIFICATIONS–ELDORADO

Material No.	Application	Size	Foot-Pounds
300-M	Rear Upper Control Arm Bolts (at axle bracket while holding nuts)	1/2–13	110*
300-M	Rear Upper Control Arm Bolts (at frame cross member while holding nuts)	9/16–12	145*
300-M	Rear Upper Control Arm Nuts (at axle bracket while holding bolts)	1/2–13	80*
300-M	Rear Upper Control Arm Nuts (at frame cross member while holding bolts)	9/16–12	100*
300-M	Rear Lower Control Arm	9/16–12	145*
275-M	Rear Upper Shock Absorber Bolts	5/16–18	12
286-M	Rear Lower Shock Absorber Attaching Nuts	1/2–20	50

**These control arm fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure the proper retention of these parts.*

Pivot bolts in control arms must be torqued when axle is under normal load. If not, the ride rate may be adversely affected.

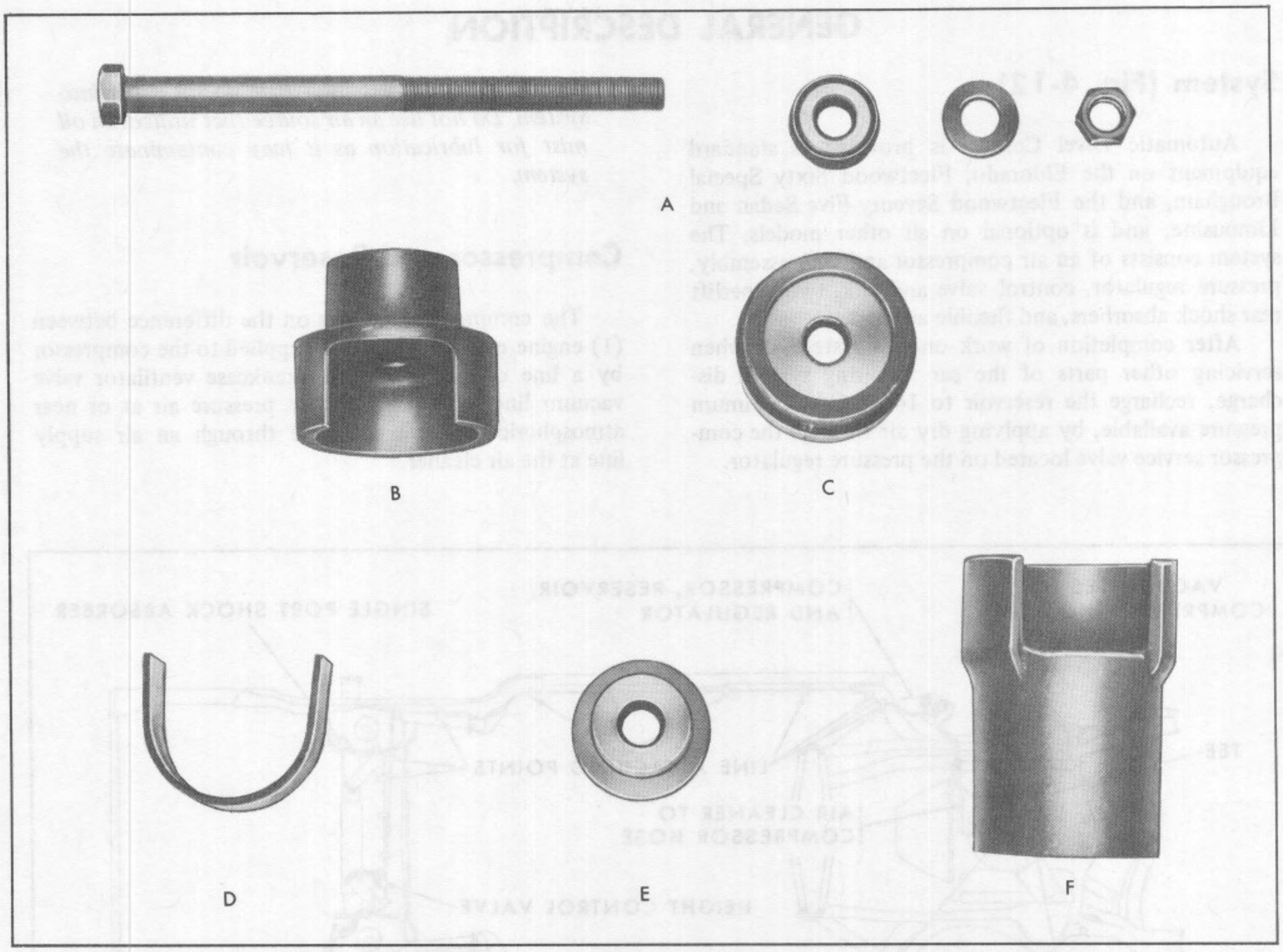


Fig. 4-11 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21474-3	Driver Bolt Set	D	J-23705	Spacer
B	J-22222-1	Bushing Installer	E	J-22222-3	Pilot
C	J-22222-2	Pilot	F	J-21474-5	Bushing Remover

GENERAL DESCRIPTION

System (Fig. 4-12)

Automatic Level Control is provided as standard equipment on the Eldorado, Fleetwood Sixty Special Brougham, and the Fleetwood Seventy-Five Sedan and Limousine, and is optional on all other models. The system consists of an air compressor and tank assembly, pressure regulator, control valve and link, two superlift rear shock absorbers, and flexible air lines.

After completion of work on this system, or when servicing other parts of the car requiring system discharge, recharge the reservoir to 140 psi or maximum pressure available, by applying dry air through the compressor service valve located on the pressure regulator.

CAUTION: It is essential that no oil is fed into system. Do not use an air source that utilizes an oil mist for lubrication as it may contaminate the system.

Compressor and Reservoir

The compressor operates on the difference between (1) engine manifold vacuum, supplied to the compressor by a line connected to the crankcase ventilator valve vacuum line, and (2) a higher pressure air at or near atmospheric pressure, available through an air supply line at the air cleaner.

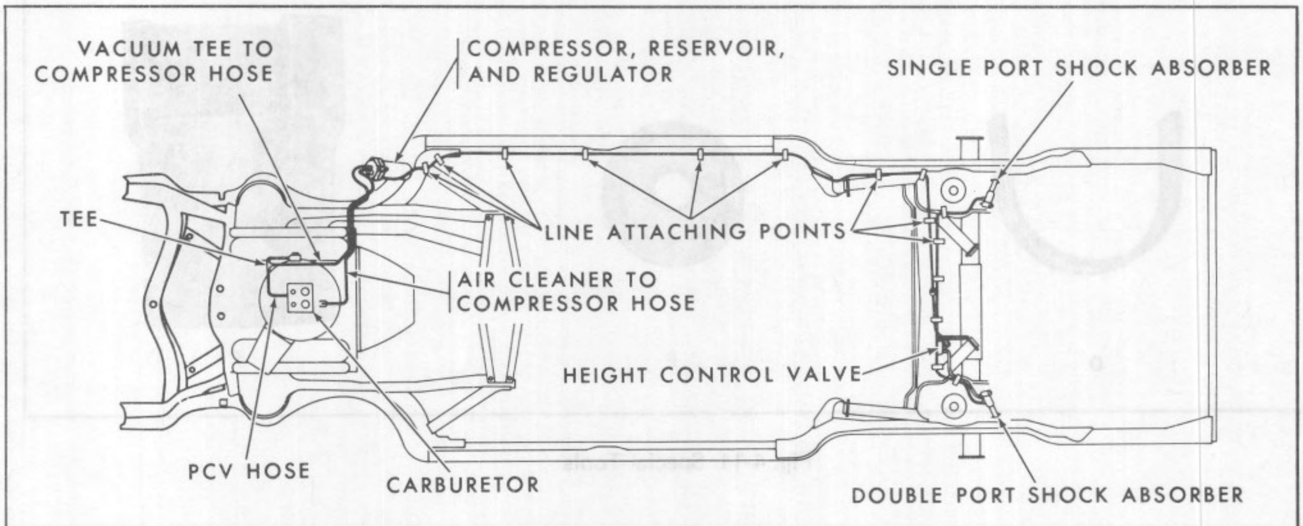


Fig. 4-12 Location of Automatic Level Control Components – Except Eldorado

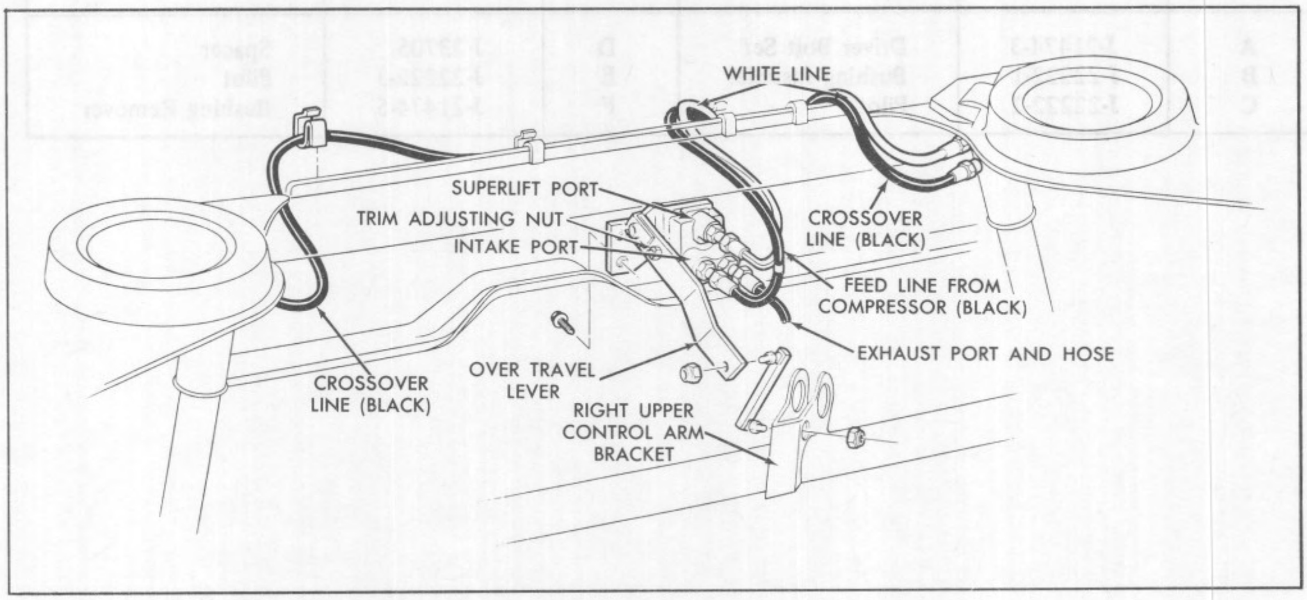
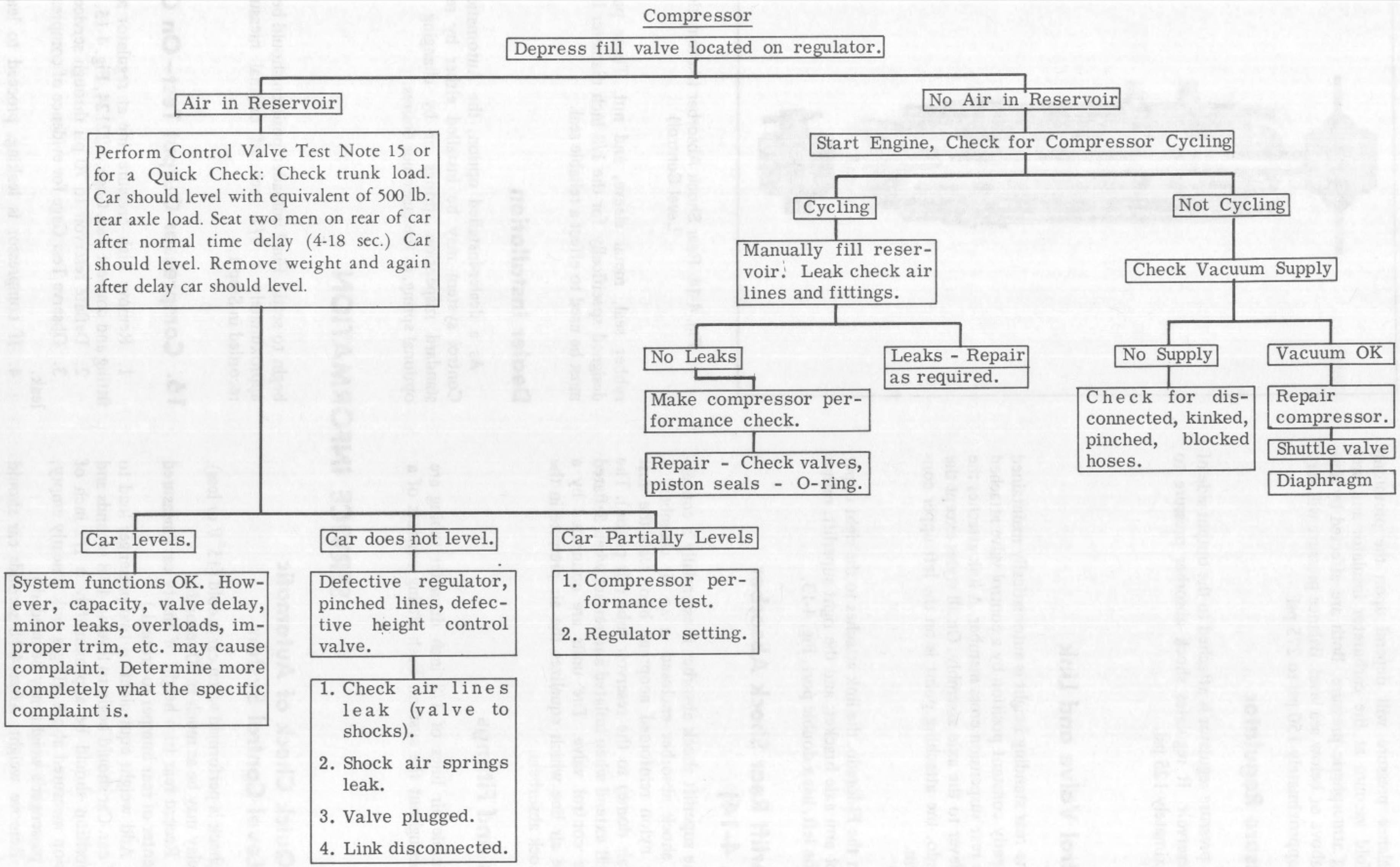


Fig. 4-13 Location of Automatic Level Control Components – Eldorado

DIAGNOSIS CHART
AUTOMATIC LEVEL CONTROL



After correcting a malfunction, recheck entire system.

Balance pressure will depend upon the prevailing manifold vacuum at the carburetor insulator and prevailing atmospheric pressure. Both are affected by altitude above or below sea level. Balance pressure will vary from approximately 150 psi to 275 psi.

Pressure Regulator

A pressure regulator is attached to the output side of the reservoir. It regulates shock absorber pressure to approximately 125 psi.

Control Valve and Link

The rear standing height is automatically maintained at a nearly constant position by a control valve attached to the rear suspension cross member. A link attaches the valve lever to the axle assembly. On all styles except the Eldorado, the attaching point is on the left upper control arm.

On the Eldorado, the link attaches to the right upper control arm axle bracket; and the right superlift, rather than the left, has a double port, Fig. 4-13.

Superlift Rear Shock Absorber (Fig. 4-14)

The superlift shock absorber is essentially a conventional shock absorber enclosed in an air chamber. A pliable nylon reinforced neoprene boot seals the dust tube (air dome) to the reservoir tube (air piston). The unit will extend when inflated and retract when deflated by the control valve. The units are connected by a flexible air line which equalizes the air pressure in the two shock absorbers.

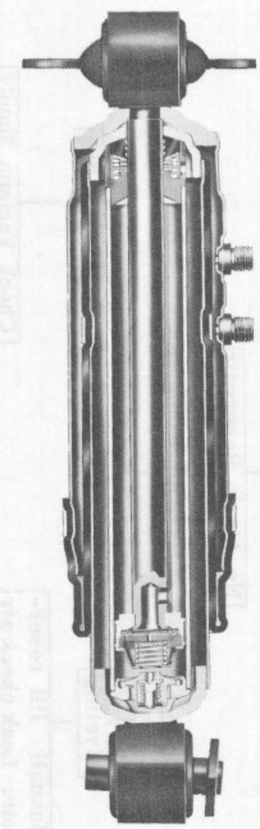


Fig. 4-14 Rear Shock Absorber (Automatic Level Control)

Lines and Fittings

Flexible air lines of 1/8 inch diameter tubing are used throughout the system. Each fitting consists of a rubber seal, metal sleeve, and nut. These parts are designed specifically for the 1/8 inch diameter line and must be used to effect a reliable seal.

Dealer Installation

As a dealer-installed option, the Automatic Level Control system may be installed either by retaining standard suspension springs or by changing to the optional spring, as the customer desires.

SERVICE INFORMATION

15. Quick Check of Automatic Level Control System

If check is performed when car is cold (15°F or less), time delay may be as much as 30 seconds.

1. Record rear trim height of empty car (measured from center of rear bumper to ground.)
2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-18 seconds and final position should be approximately ± 1/2 inch of dimension measured above. (If gas tank is nearly empty, a third passenger's weight may be needed.)
3. Remove weight. After 4-18 seconds car should begin to settle. Final unloaded position should be within approximately ± 1/2 inch of original measurement recorded in Step 1.

16. Compressor Output Test—On Car

1. Remove high pressure line at regulator adapter fitting and connect Test Gage, J-22124, Fig. 4-15.
2. Deflate reservoir to 70 psi through service valve.
3. Observe Test Gage for evidence of compressor air leak.
4. If compressor is leaking, proceed to leak test

compressor reservoir and regulator as described in Note 17a. If not leaking, continue this test.

5. With engine running at slow idle and reservoir pressure at 70 psi, observe reservoir build-up for five minutes. Reservoir pressure should build-up to a minimum of 100 psi at 15 inch vacuum. A minimum of 14 inches of vacuum must be available, or test may not be reliable.

6. If compressor fails to cycle, make sure the vacuum and air intake lines are not reversed and are open and unobstructed before removing compressor for repair. Check for pinched or kinked vacuum hoses.

7. If build-up is too slow, and a recheck of vacuum and intake hoses show no restrictions, repair compressor as outlined in Notes 24, 25 and 26.

8. Satisfactory pressure build-up indicates compressor is functioning properly. Continue to build up pressure and perform regulator check as described in Note 18.

9. If no leaks are detected and compressor and regulator functions properly, remove test gage. Install high pressure line and proceed to Control Valve Test, Note 17.

17. Control Valve Test

If tests are performed when car is cold, (15°F or less) time delay may be as much as 30 seconds.

a. Intake – Reservoir Pressure 125 psi Minimum

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position until shock absorbers inflate or for a minimum of 18 seconds.

3. If shock absorbers inflate and hold, proceed to Time Delay Check.

4. If shock absorbers inflate and then leak down, perform leak test on lines and fittings and then on shock absorbers, Note 17d.

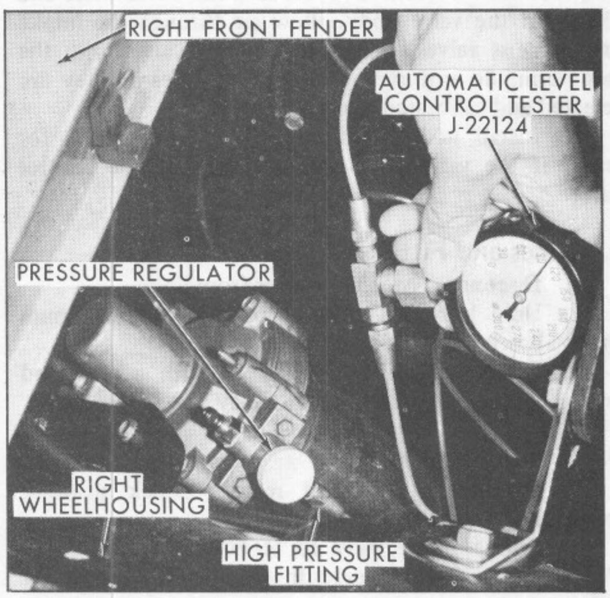


Fig. 4-15 Testing Compressor Output

5. If shock absorbers inflate with the lever in the neutral position, perform leak check on valve.

6. If shock absorbers do not inflate, check air source. Also check and, if necessary, replace intake and shock absorber screens and O-rings, If shock absorbers still do not inflate, perform leak test on valve, Note 19b. Repair as indicated and proceed to time-delay check.

b. Exhaust – Shock Absorbers Inflated

1. Disconnect overtravel lever from link.

2. Hold lever down in exhaust position until shock absorbers deflate or for a minimum of 18 seconds.

3. If shock absorbers deflate, perform Intake Check.

4. If shock absorbers do not deflate, remove exhaust adapter from control valve and hold lever down as in Step 2. Replace adapter, O-ring, and filter if this deflates shock absorbers.

5. If shock absorbers deflate with lever in neutral position, perform leak checks on lines and fittings. If continuous leakage appears at exhaust valve port, check control valve for leaks, Note 19b.

6. Replace control valve if none of the above steps correct the condition.

c. Time Delay Check

1. Disconnect overtravel lever from link.

2. Disconnect lines at shock absorbers and intake ports.

3. Connect Test Gage J-22124, to intake valve port and open air pressure (95 psi). Move overtravel lever approxiately one inch down from neutral position as measured from end of lever, and hold for 15-20 seconds.

4. Quickly move overtravel lever upward two inches and note number of seconds before air starts to escape from shock absorber port. This delay should be from 4-18 seconds. Repeat check. This will check the air intake time delay. Proceed with check to determine air exhaust time delay.

5. Remove Test Gage and plug intake port with Fill Valve, J-21999, (female end).

6. Connect Test Gage to shock absorber port and open air pressure (95 psi). Move overtravel lever approximately one inch up from neutral position as measured from end of lever, and hold for 15-20 seconds.

7. Quickly move overtravel lever downward two inches; at the same time begin timing number of seconds until air begins to escape from exhaust port. This delay should be 4-18 seconds. Repeat check.

If either delay is not within specification, replace the leveling control valve and proceed to Trim Adjustment On Car, Note 20.

18. Regulator Test

Performance test the regulator with a known good compressor on the car.

1. Delfate system through service valve, remove line at regulator and connect Test Gage, J-22124, at regulator adapter.

2. Inflate reservoir through service valve to

maximum pressure available. If less than 140 psi, start engine to build up reservoir to this pressure.

3. Regulated pressure on the Test Gage should build up to 100-130 psi and hold steady within this pressure.

4. Recheck regulated pressure by momentarily depressing valve core on Test Gage and observe gage reading.

5. If regulated pressure exceeds 130 psi, replace regulator as a unit.

19. Leak Tests

a. Compressor, Reservoir, and Regulator

1. Remove assembly, Note 23a.

2. Connect Test Gage to regulator. Inflate reservoir through service valve to 80-110 psi.

3. Route an eight inch rubber hose between vacuum and vent ports, Fig. 4-16.

4. While holding assembly in a vertical position with reservoir end down, immerse in water until the diaphragm is just submerged, Fig. 4-16. Do not submerge completely, as water can enter around the cover gasket. Observe for air leaks at:

- Reservoir weld seam.
- Reservoir to compressor O-ring. A stream of bubbles may appear in this area and then cease. The bubbles are caused by atmospheric air being purged from air pockets in the second stage housing. If the bubbles stop in 20 seconds or less there is no leak.
- Regulator to compressor O-ring.
- Regulator boot - defective internal O-ring.
- Diaphragm between first and second stage housings - tightening through-bolts may correct the leak.
- Service valve.
- Test gage connections.

5. Remove hose from vacuum port and submerge disconnected end in water. Cover vacuum port with finger. Do not permit water to enter through vacuum port. If bubbles are evident, the probable cause is a defective second stage housing check valve.

6. Correct any leaks by either tightening screws or replacing parts.

7. If the cover gasket area is inadvertently submerged, remove cover and tilt unit so that water may drain through openings by distributor valve mechanism. Move distributor valve from side to side until all water is purged. Dry both the distributor valve mechanism and the interior of the cover with compressed air. Replace cover.

If the compressor passes this test, yet fails the output test, overhaul the compressor, reservoir, and regulator assembly.

b. Control Valve

1. Remove control valve from car as described in Note 22a.

2. Clean exterior of control valve thoroughly.

3. Connect Test Gage, J-22124, and air pressure source to intake adapter and open air pressure (80-110 psi).

4. Submerge unit in water. No air should escape if

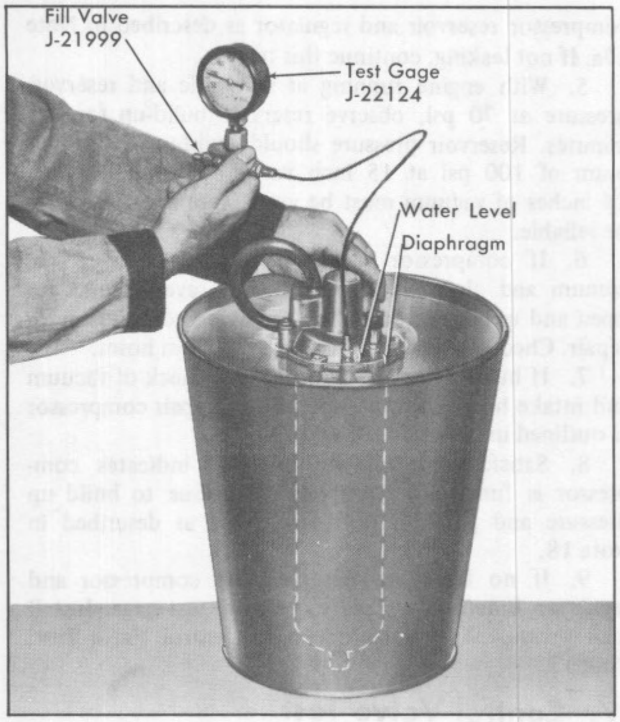


Fig. 4-16 Checking Compressor For Leaks

overtravel lever is in "neutral" position. If bubbles escape from shock absorber port, proceed to step 8.

5. Shut off air pressure and detach test gage from air intake port. Plug intake port with Fill Valve, J-21999, (female end).

6. Connect Test Gage to shock absorber port and open air pressure.

7. With overtravel lever in "neutral" position no air should escape. If bubbles escape from exhaust port, proceed to step 8.

8. If the intake valve or exhaust valve is leaking with the lever in the neutral position, as evidenced in Step 5, Notes 17a and 17b, remove the cover plate and clean out the valve body. Blow air through the intake and exhaust valves while actuating the valves with the lever arm, do not remove the valve cores as they are selected and calibrated in each valve.

9. Install gasket and cover plate and check for leaks. If the valve cores still leak, replace the control valve.

c. Lines and Fittings

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position for maximum shock absorber inflation and release.

3. Leak check all connections, with a soap and water solution. Leak test solution may also be used.

d. Shock Absorbers

1. Disconnect lines and remove shock absorber from car as described in Note 2a.

2. Inflate individually to 50-60 psi, utilizing Fill Valves, J-21999. Submerge in water and observe for leaks.

3. Install shock absorbers as described in Note 2b.

20. Trim Adjustment—On Car

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of 6 lbs/gallon).

a. Preparation

1. Raise car with rear axle supported.
2. Remove shock absorber line at control valve.
3. Connect a Fill Valve Assembly, J-21999, to this line (male end).
4. Inflate shock absorbers to 8-15 psi. Move car up and down to neutralize suspension.
5. Connect Test Gage, J-22124, to shock absorber adapter on control valve and attach air pressure source (80-110 psi).

b. Adjustment

1. Loosen overtravel lever adjusting nut.
2. Hold overtravel body down in exhaust position until air escapes from exhaust valve port.
3. Slowly move overtravel body and tighten nut at the point of minimum air bleed. With nut tight, a slight continuous air bleed will still be noticeable.

c. Restore System

1. Remove Test Gage and air pressure source from shock absorber adapter.
2. Remove Fill Valve Assembly, J-21999, from shock absorber line and reconnect line to control valve.
3. Lower car and inflate reservoir through service valve.

21. Tubing (Fig. 4-17)

(NOTE: Tubing may be removed by simply unscrewing nut. Be sure system is deflated when separating air lines. When installing tubing at any Automatic Level Control fitting, be careful not to kink line.)

1. Preassemble metal sleeve and rubber seal.
2. Place nut on tubing.
3. Insert tube into metal sleeve and rubber seal until tube bottoms.

(NOTE: Be careful not to extend tubing completely through rubber seal.)

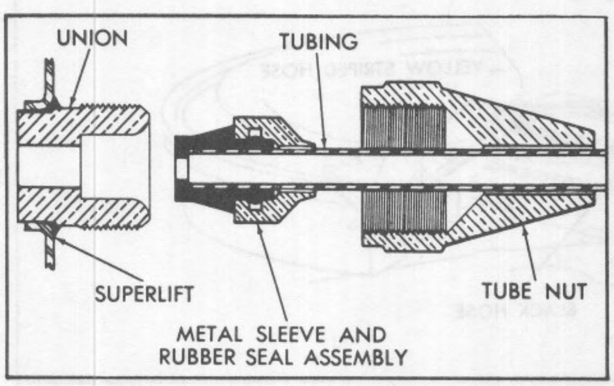


Fig. 4-17 Typical Tubing Fitting

4. Holding tubing in bottomed position, tighten tube nut securely (30-40 inch pounds).

(NOTE: Tubing may be reinstalled at its connections. If tubing is cracked at end, it will be necessary to cut flush and use a new metal sleeve and rubber seal to assemble connector. Be careful not to remove too much, or tubing may be kinked or broken at full suspension travel. Care should be taken that proper routing is followed in areas close to the exhaust system to prevent burning the tubing. Note particularly the areas at rear suspension cross member.)

22. Height Control Valve

a. Removal

1. Deflate system, using service valve.
2. Disconnect air lines at leveling valve intake and shock absorber ports.
3. Disconnect link from overtravel lever by removing nut.
4. Remove two screws securing leveling valve to frame and remove leveling valve.

b. Installation

1. Install leveling valve with two screws, with time delay mechanism down.
2. Secure link to overtravel lever with retaining nut.

(NOTE: If working on limousine, use lower hole in overtravel lever.)

3. Connect air lines at control valve intake and at shock absorber port, assembling tubing as described in Note 19.

(NOTE: Line from upper port of control valve to double port shock absorber is white. This white line can be connected to either upper or lower port of shock absorber.)

4. Inflate reservoir to 140 psi or maximum pressure available through service valve.

23. Compressor, Regulator, and Reservoir Assembly

a. Removal

1. Raise hood and deflate system.

(NOTE: Compressor is on rear of right wheelhousing).

2. Remove air intake and vacuum hoses from compressor fittings.
3. Remove high pressure line from regulator fitting.
4. Remove three screws securing compressor to rear of right wheelhousing, screws are accessible inside wheelhousing.
5. Remove compressor and brackets from wheelhousing.
6. Remove nuts and lockwashers securing mounting brackets to flexible mounts on compressor assembly and remove mounting brackets.

b. Installation

(NOTE: The 1973 and 1974 compressor mounting bracket will only fit the mounting holes of a 1973 and 1974 front fender dustshield. If using as a replacement for earlier cars, the dustshield must be reworked.)

1. Position mounting brackets to flexible mounts and secure with lockwashers and nuts.
2. Position mounting brackets to right wheelhousing with compressor end of assembly facing up.
3. Install three screws securing compressor to wheelhousing.
4. Install high pressure line on regulator fitting, following procedure described in Note 21.
5. Install air inlet hose (yellow striped) to vent fitting, Fig. 4-18.
6. Install vacuum hose (black) to vacuum fitting.
7. Inflate reservoir to 140 psi or maximum pressure available through service valve.
8. Lower hood.

24. Disassembling Compressor, Reservoir, and Regulator into Major Components (Fig. 4-19)

The compressor is a precision-built mechanism. All parts should be carefully handled and assembled. Take care to prevent entrance of dirt or foreign matter. DO NOT LUBRICATE as unit is designed to run dry.

1. Remove compressor as described in Note 23a.
2. Remove two flexible mounts and two adapters.
3. Remove reservoir retaining through bolt, cover retaining screw, and cover gasket that secure cover and gasket to first stage housing. Remove cover and discard gasket, if necessary.
4. Remove two regulator retaining screws, regulator assembly, and O-ring from second stage housing. Discard O-ring, if necessary.
5. Remove three nuts at reservoir flange and two through bolts that enter from flanged side of reservoir. Separate reservoir and O-ring. Discard O-ring, if necessary.
6. Remove three compressor retaining through bolts that secure second stage housing to first stage housing.
7. Slide second stage (small diameter) housing straight off piston.
8. Disconnect arm tension spring from swivel arm.
9. Remove air pivot screw and actuating arm.
10. Slide piston assembly straight out of first stage housing.

25. Compressor, Reservoir, and Regulator; Disassembly, Inspection, and Assembly of Major Components

a. Diaphragm

Inspection

1. Inspect diaphragm for holes, looseness, or other defects and replace as necessary.

Disassembly

1. Remove diaphragm retainer with snap ring pliers.
2. Remove diaphragm plate, diaphragm, second diaphragm plate, and washer from piston.

Assembly

1. Install new washer, old plate, new diaphragm

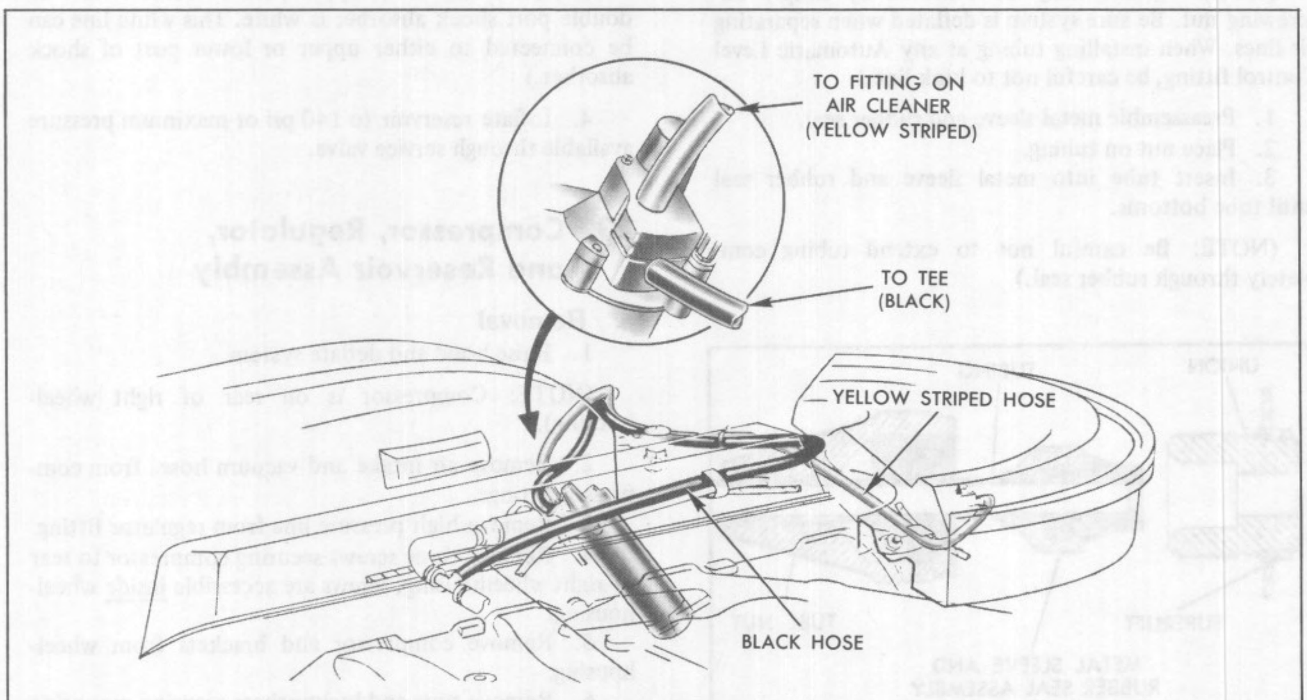


Fig. 4-18 Automatic Level Control Compressor Hose Connections

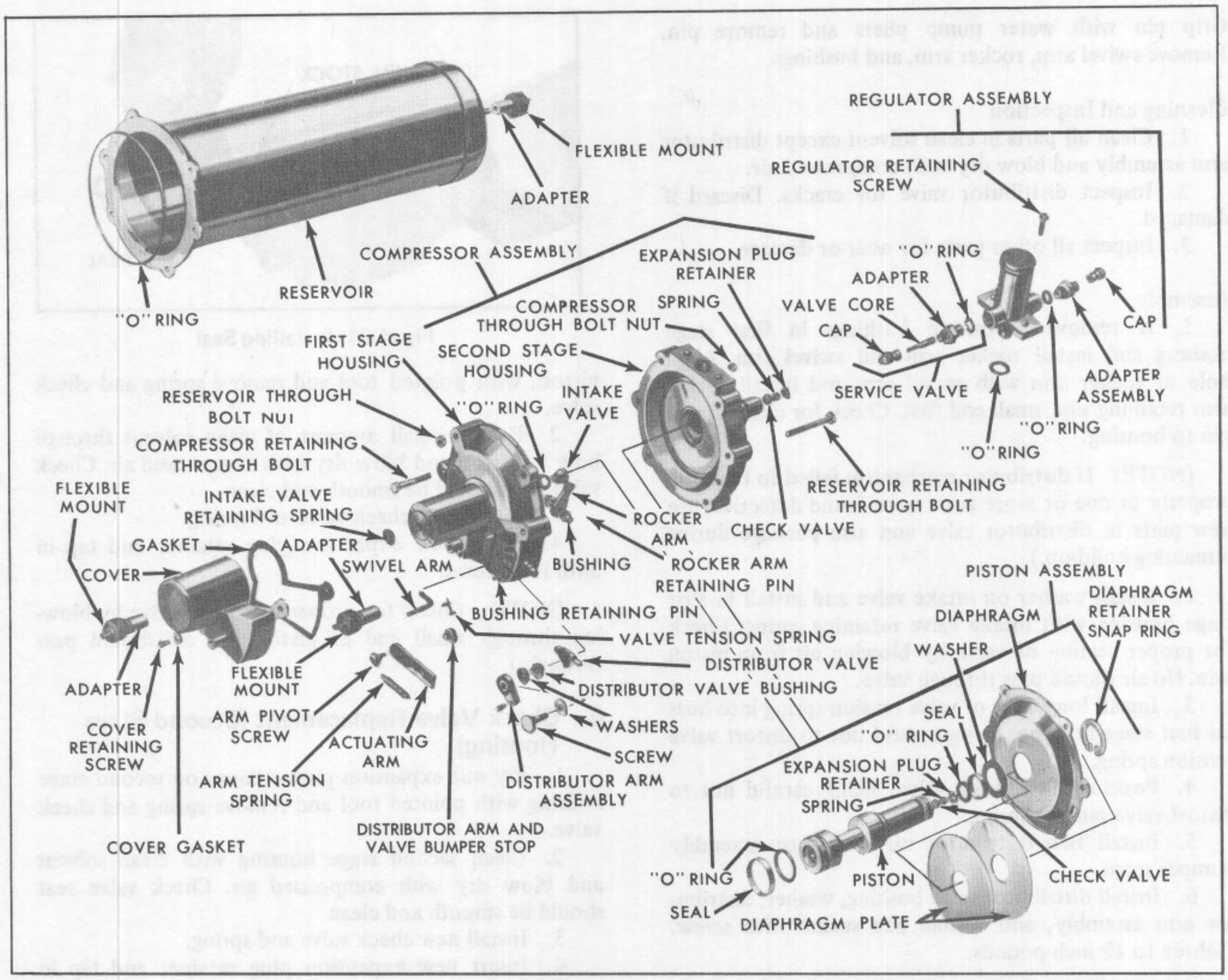


Fig. 4-19 Compressor Assembly Disassembled

with outer lip toward second stage side, Fig. 4-19, and second plate. Plates should be installed so that lips on plates face outboard from diaphragm.

2. Install diaphragm retainer snap ring on groove in piston, Fig. 4-20.

b. Piston Seals

Inspection

1. Inspect seals for evidence of excessive wear or scoring. If necessary, replace seals and O-rings.

Removal

1. Remove seals and O-rings from piston.

Installation

1. Install new O-rings by rolling into groove. Relieve any resulting twist.

2. Install new seals using a piece of .020" shim stock, Fig. 4-21. Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than necessary to install. Seals should be installed so they are not twisted.

c. Distributor Valve Mechanism and Intake Valve – First Stage Housing

(NOTE: Actuate distributor valve with finger. Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild, using new parts in distributor valve and arm package. If action is free and positive, and inspection upon disassembly shows no damaged parts, parts may be re-used.)

Disassembly

1. Remove screw, washer, distributor arm assembly, washer, and distributor valve bushing.

2. Remove two distributor valve and arm assembly bumper stops.

3. Remove distributor valve, being careful not to distort valve tension spring.

4. Remove distributor valve tension spring from first stage housing boss, again being careful not to distort valve tension spring.

5. Remove intake valve retaining spring, intake valve, and washer, using pocket knife.

6. If necessary, remove rocker and swivel arms.

Grip pin with water pump pliers and remove pin. Remove swivel arm, rocker arm, and bushings.

Cleaning and Inspection

1. Clean all parts in clean solvent except distributor arm assembly and blow dry with compressed air.
2. Inspect distributor valve for cracks. Discard if damaged.
3. Inspect all other parts for wear or damage.

Assembly

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align hole in rocker arm with swivel arm and install rocker arm retaining pin, small end first. Check for clearance of pin to housing.

(NOTE: If distributor mechanism failed to function properly or one or more parts were found defective, use new parts in distributor valve and arm package during remaining build-up.)

2. Install washer on intake valve and install in first stage housing with intake valve retaining spring. Check for proper seating of valve by blowing air from piston side. No air should pass through valve.
3. Install longer leg of valve tension spring into boss on first stage housing, being careful not to distort valve tension spring.
4. Position distributor valve, being careful not to distort valve tension spring.
5. Install two distributor valve and arm assembly bumper stops.
6. Install distributor valve bushing, washer, distributor arm assembly, and washer and secure with screw. Tighten to 12 inch-pounds.

(NOTE: Do not install remaining parts at this time as rocker arm must be free to permit entrance of piston into first stage housing.)

d. Check Valve Replacement (Second Stage Piston)

1. Pry out expansion plug retainer on second stage

Fig. 4-20 Removing and Installing Snap Ring

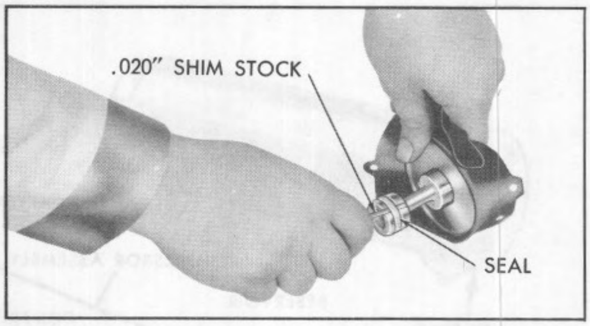


Fig. 4-21 Installing Seal

piston, with pointed tool and remove spring and check valve.

2. Pour a small amount of clean solvent through bore in piston and blow dry with compressed air. Check valve seat should be smooth and clean.
3. Install new check valve and spring.
4. Insert new expansion plug retainer and tap in until it bottoms.

(NOTE: Check for proper seating of valve by blowing through small end of piston. No air should pass through.)

e. Check Valve Replacement (Second Stage Housing)

1. Pry out expansion plug retainer on second stage housing with pointed tool and remove spring and check valve.
2. Clean second stage housing with clean solvent and blow dry with compressed air. Check valve seat should be smooth and clean.
3. Install new check valve and spring.
4. Insert new expansion plug retainer and tap in until it bottoms.

(NOTE: Check for proper seating of valve by blowing through small end. No air should pass through.)

26. Assembling Compressor, Reservoir, and Regulator from Major Components

1. Slide piston assembly straight into first stage (large diameter) housing.
2. Install actuating arm and attach to first stage housing with arm pivot screw.
3. Connect arm tension spring to swivel arm.
4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in first stage housing.
5. Install three compressor retaining through bolts that secure second stage housing to first stage housing. Housings will align one way only. Nuts are positioned in counterbores in second stage housing. Tighten to 28 inch-pounds. Check for free operation of valve parts.
6. Install new O-ring on second stage housing. Wash inside of reservoir in clean solvent and blow dry with compressed air. Install reservoir on second stage housing with three nuts, tightening to 28 inch-pounds. Install two reservoir retaining through bolts, tightening to 28

inch-pounds. Through bolt heads should be positioned against reservoir. Do not install through bolt that secures cover at this time.

7. Install new O-ring on regulator and secure regulator with two regulator retaining screws Tighten to 35 inch-pounds. Service valve should be on same side as first stage housing.

8. Install new gasket and cover, and secure with cover retaining screw and new cover gasket. Tighten cover retaining screw to 35 inch-pounds. Install through bolt with head positioned against reservoir. Tighten through bolt to 28 inch-pounds.

9. Install two adapter and flexible mounts.

10. Proceed to compressor output test on car, Note 16.

11. If compressor passes output test, install as outlined in Note 23b.

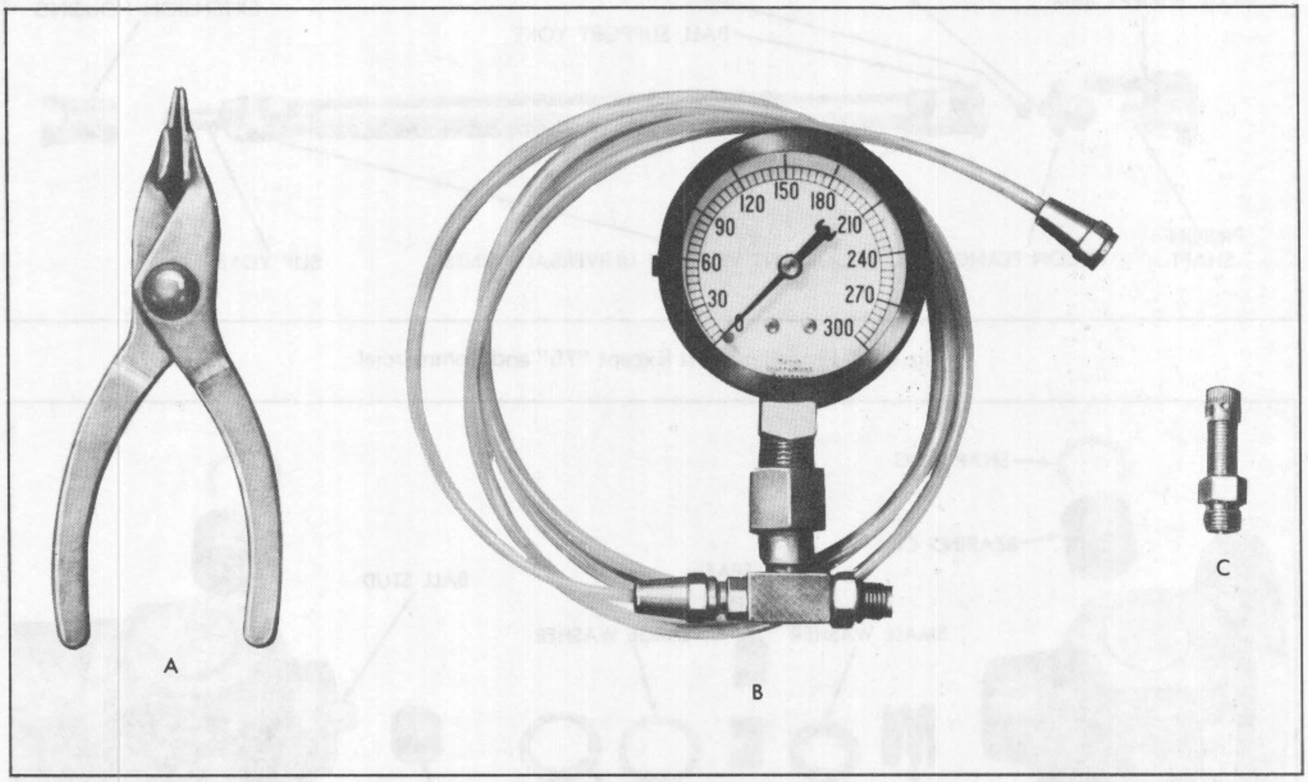


Fig. 4-22 Special Tools

Key	Tool No.	Name
A	J-4880	#22 Snap Ring Pliers
B	J-22124	Test Gage
C	J-21999	Fill Valve

GENERAL DESCRIPTION

Propeller Shaft—Except Seventy-Five and Commercial

A one-piece propeller shaft assembly, Fig. 4-23, is used on all styles except the Fleetwood Seventy-Five Sedan and Limousine and the Commercial Chassis. A longer one-piece shaft is used on the Fleetwood Sixty Special Brougham due to the longer wheel base on this body style.

Double Cardan constant velocity universal joints, Fig. 4-24, are used on both the front and rear of the shaft. A Double Cardan joint consists of two single joints connected by a special link yoke. A ball and socket centering device is located between the crosses to maintain their relative positions, causing each cross to operate through one half of the total angle across the joint.

Any time a constant velocity joint is disassembled,

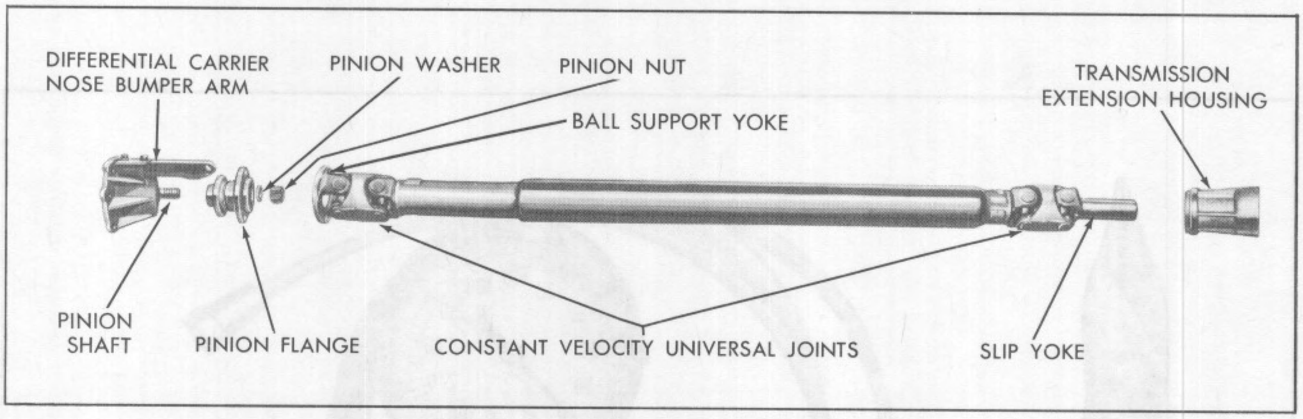


Fig. 4-23 Propeller Shaft Except "75" and Commercial

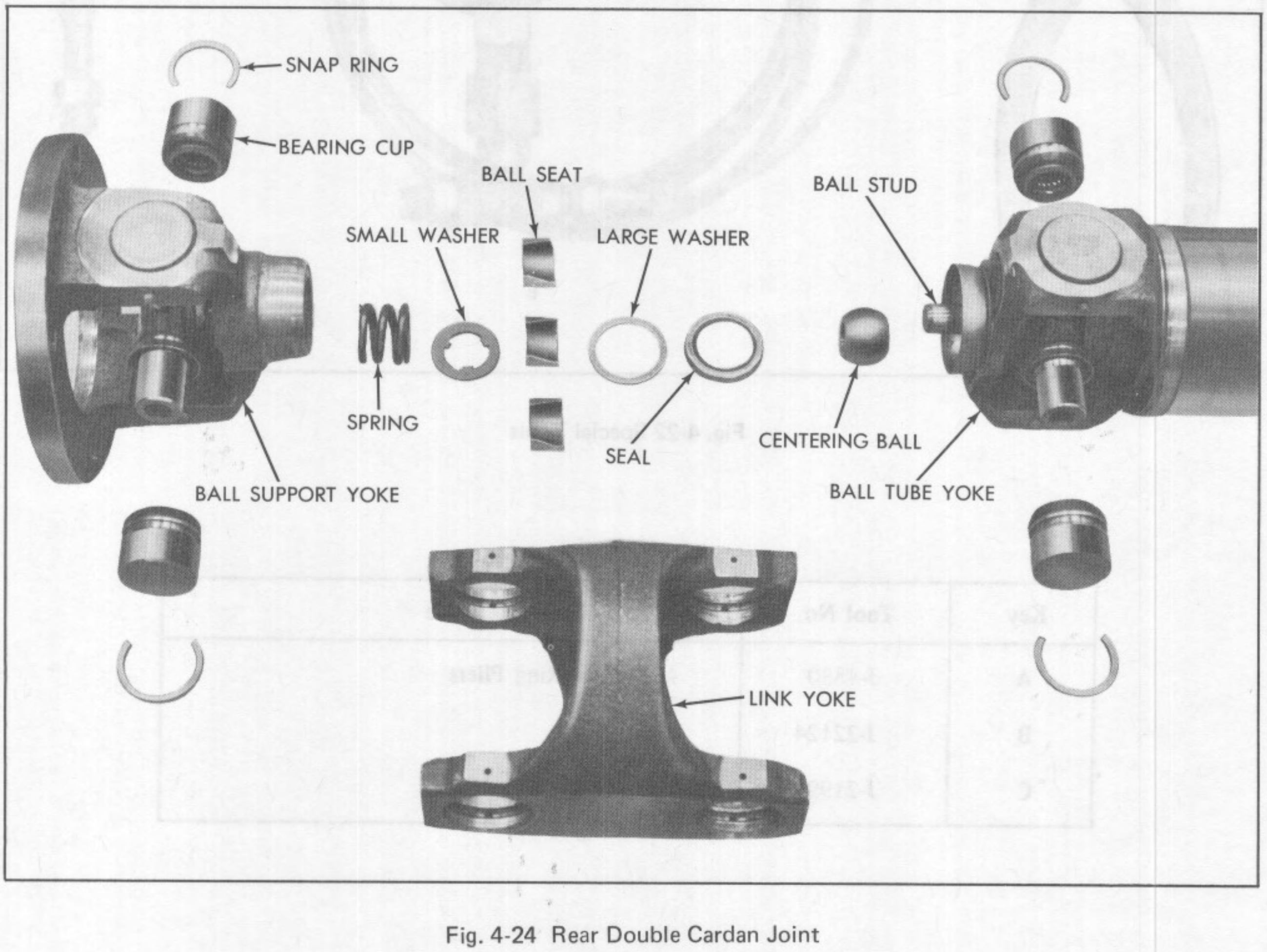


Fig. 4-24 Rear Double Cardan Joint

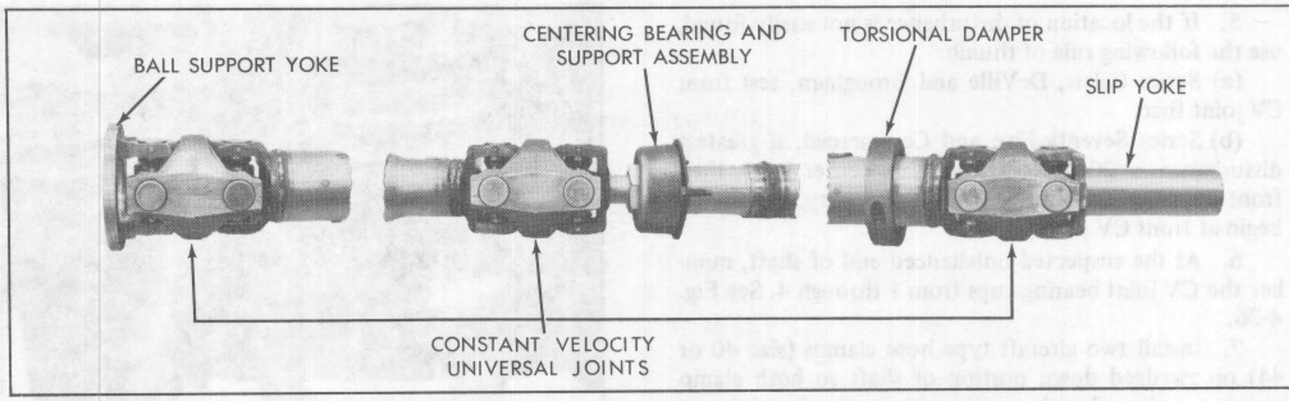


Fig. 4-25 Propeller Shaft "75" and Commercial

inspect the centering ball for corrosion, distortion or wear before continuing procedure. A new replaceable centering ball is used, avoiding the need to replace the entire shaft if such wear exists. A replacement ball seat kit must be installed in the corresponding yoke whenever a centering ball is replaced.

Propeller Shaft—Seventy-Five and Commercial

A two-piece propeller shaft assembly, Fig. 4-25, is used on the Fleetwood Seventy-Five Sedan, Limousine and the Commercial Chassis. Attachments at the transmission output shaft and differential carrier are identical to those of the single piece shaft. Double Cardan joints are located at each end and in the center of the propeller shaft assembly.

The assembly is supported at the center by a center bearing and support and bracket assembly attached to a frame cross member.

As on the one-piece shaft, components that can be serviced separately from the tube include the centering ball, ball seat assembly, bearing cups, crosses, link yokes, slip yoke, ball support yoke and the torsional damper.

In addition, the center bearing and the center bearing support assembly are serviceable.

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, suspension control arms, and transmission cooler pipes.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

27. Propeller Shaft Rebalancing—On Car

1. Road test car (with owner if possible) to determine nature and speed ranges of complaint.

2. Raise car so that rear axle housing is supported and remove rear wheel and tire assemblies.

3. If car was not road tested, start engine, engage transmission and run speedometer slowly from 0-80 MPH. Note speeds at which roughness is closest to owner's complaint.

(NOTE: Disturbance due to propeller shaft unbalance on Calais, DeVille and Brougham series is most likely to occur at 30-35 MPH or at freeway speeds (approximately 60 MPH). On Seventy-Five and commercial styles, unbalance is likely to peak at 24-28 MPH or 32-35 MPH.)

4. If car is equipped with torsional damper, remove damper and re-evaluate at offending speed ranges. If there is no difference with damper removed, on "C" cars, it is not necessary to reinstall damper unless car is used for trailer towing.

(NOTE: Torsional damper must be reinstalled on Seventy-Five and Commercial series cars.)

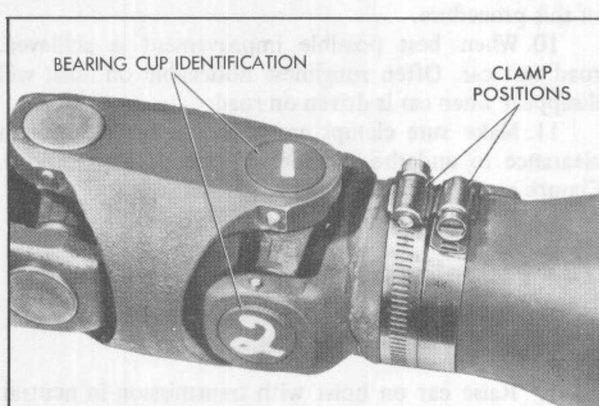


Fig. 4-26 Clamps In Position 1

5. If the location of disturbance is not easily found, use the following rule of thumb:

(a) Series Calais, DeVille and Brougham, test front CV joint first.

(b) Series Seventy-Five and Commercial, if greatest disturbance is 20-30 MPH, begin at center joint, then front joint and finally rear joint if necessary. Otherwise, begin at front CV joint.

6. At the suspected unbalanced end of shaft, number the CV joint bearing cups from 1 through 4. See Fig. 4-26.

7. Install two aircraft type hose clamps (size 40 or 44) on swedged down portion of shaft so both clamp screws are aligned with position #1 on the first joint to 1, Fig. 4-25.

EVALUATION CHART

CLAMP POSITIONS		#1	#2	#3	#4
FRONT CV JOINT	Two Clamps				
	Three Clamps				
REAR CV JOINT	Two Clamps				
	Three Clamps				

W - Worse
N - No Change
I - Improved Slightly
S - Substantial Improvement
A - Acceptable

8. Run rear wheels to speed of distrubance and evaluate. Indicate test results on evaluation chart as shown above.

9. Rotate clamps to position 2 and repeat Step 8. Continue test until all four positions have been checked.

If improvement is found at any location, add another clamp and check for further improvement. Do not add more than five clamps in this manner.

If more weight is required to balance joint, propeller shaft should be removed from car and sent to an approved machine shop for rebalance.

If no improvement is found at any of the four positions, proceed to next joint and repeat Steps 6 through 8 of this procedure.

10. When best possible improvement is achieved, road test car. Often roughness noticeable on hoist will disappear when car is driven on road.

11. Make sure clamps are tight and have sufficient clearance to underbody under all operating conditions. Clamps are to be left on car as permanent fixture.

12. Lower car to floor.

28. Propeller Shaft Assembly—Except Seventy-Five and Commercial

a. Removal

1. Raise car on hoist with transmission in neutral. Mark shaft relationship to axle pinion flange.

2. Remove two accessible ball support yoke attaching screws and lock washers.

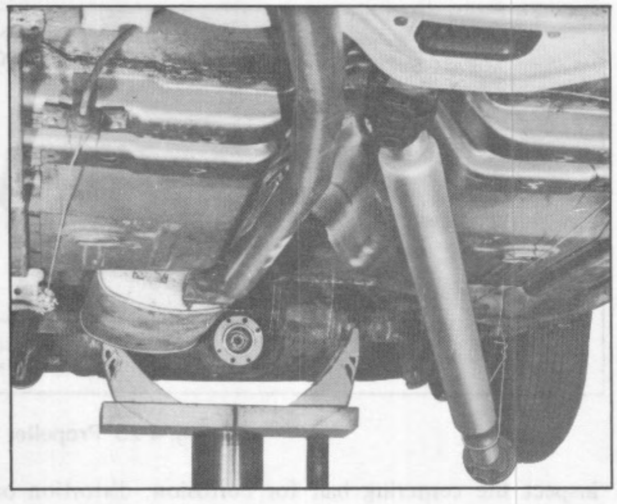


Fig. 4-27 Supporting Propeller Shaft

CAUTION: Do not permit propeller shaft to be supported by the front universal joint only, as damage may result. Rear of propeller shaft must be supported to underbody. A fan belt or piece of wire may be used, Fig. 4-27.

3. Rotate propeller shaft and remove two remaining screws and lock washers.

(NOTE: Have container ready to catch fluid which may leak from transmission when slip yoke is removed.)

4. Remove propeller shaft by pushing shaft forward to clear pinion flange, then pull shaft rearward to disengage slip yoke.

5. Install a clean cardboard shipping cover or similar device on slip yoke, to protect it from damage.

6. Install spare slip yoke into transmission extension housing to prevent loss of fluid and entrance of dirt.

b. Installation

1. Remove any nicks, burrs, dirt or rust from differential pinion flange face and from face of mating flange of ball support yoke.

2. Remove cardboard cover and clean slip yoke if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of propeller shaft slip yoke lubricant, Part No. 105 0169, or equivalent and lubricate O.D. with transmisssion fluid.

3. Remove spare yoke previously installed in transmission extension housing, and pack slip yoke lubricant between lips of transmission extension housing seal. Install slip yoke on transmission output shaft.

4. Position ball support yoke flange to pinion flange as marked upon removal and install two screws and lock washers. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Engage emergency brake or service brake to hold propeller shaft when tightening flange attaching screws. Do not use a pry bar or heavy tool as universal joint bearing seals could be damaged.

5. Rotate propeller shaft to gain access to two remaining screw holes.

6. Install remaining two attaching screws and lock washers. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

7. Lower car and check transmission fluid level as described in Section 7, Note 6.

29. Propeller Shaft Assembly—Seventy-Five and Commercial

a. Removal

1. Raise car on hoist with transmission in neutral. Mark shaft relationship to axle pinion flange.

2. Remove two accessible ball support yoke attaching screws and lock washers.

CAUTION: Do not permit propeller shaft to be supported by the front or center universal joint only, as damage may result. Rear of propeller shaft must be supported to underbody. A fan belt or piece of wire may be used, Fig. 4-27.

3. Rotate propeller shaft and remove two remaining screws and lock washers.

4. Pull rear half of shaft forward to clear pinion flange and support rear end of shaft.

5. Remove the two center bearing support to frame bolts and nuts.

(NOTE: Have container ready to catch fluid which may leak from transmission when slip yoke is removed.)

6. Slide propeller shaft rearward until slip yoke comes off of transmission output shaft and install cardboard shipping cover, or similar protective device on slip yoke. The cardboard cover will prevent nicking of the yoke during removal as well as keeping the yoke as clean as possible.

7. On Seventy-Five series cars, lower propeller shaft from chassis. On Commercial series, withdraw propeller shaft through frame cross member, removing it from the rear.

8. Install a spare yoke into transmission extension housing to prevent loss of fluid and entrance of dirt.

b. Installation

1. Remove any nicks, burrs, dirt, or rust from differential pinion flange face and from face of mating flange of ball support yoke.

2. Remove cardboard cover and clean slip yoke, if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of propeller shaft slip yoke lubricant, Part No. 105 0169 or equivalent.

3. On Commercial series cars, perform the following procedure:

a. Replace cardboard cover on yoke.

b. Slide propeller shaft assembly through frame cross member from rear of car.

c. Support rear of shaft to underbody with fan belt or piece of wire.

d. Remove cardboard cover from yoke and lubricate O.D. of yoke with transmission fluid.

4. On Seventy-Five series cars, lubricate O.D. of slip yoke with transmission fluid. Insert rear portion of propeller shaft in support and support front section of shaft by hand.

5. Remove spare yoke previously installed in transmission extension housing and pack slip yoke lubricant between lips of transmission extension housing seal. Install slip yoke on transmission output shaft.

6. Install two bolts and nuts securing center bearing support to frame cross member, tightening to 16 foot-pounds.

7. Remove from support and position ball support yoke flange to pinion flange as marked upon removal and install two screws and lock washers. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Engage emergency brake or service brake to hold propeller shaft when tightening flange attaching screws. Do not use a pry bar or heavy tool as universal joint bearing seals could be damaged.

8. Rotate propeller shaft to gain access to two remaining screw holes.

9. Install remaining two attaching screws and lock washers. Torque screws to 70 foot-pounds. Remove support wire or belt used to support rear of shaft.

See CAUTION on Page 4-3.

10. Lower car and check transmission fluid level as described in Section 7, Note 6.

30. Propeller Shaft Torsional Damper—Seventy-Five and Commercial Only

a. Removal

1. Raise car with transmission in Neutral.

(NOTE: The torsional damper is machined as an assembly. Use extreme care to prevent mixing halves. Mark damper relationship to propeller shaft.)

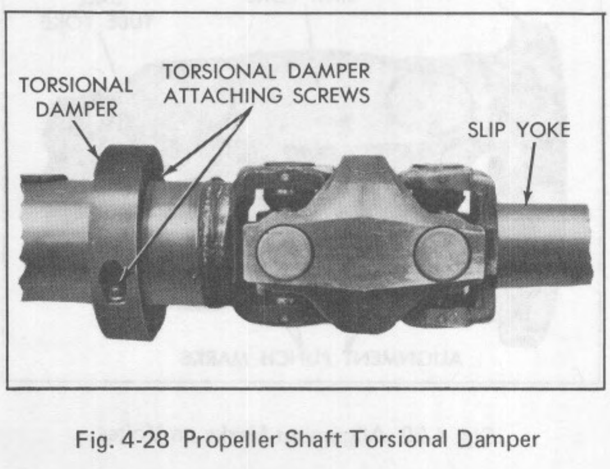


Fig. 4-28 Propeller Shaft Torsional Damper

2. Remove one of two hex head screws securing split ring torsional damper to front of propeller shaft, Fig. 4-28.

3. Rotate propeller shaft to gain access to remaining screw.

4. Remove remaining screw and remove torsional damper from propeller shaft.

b. Installation

1. Position torsional damper on propeller shaft as marked upon removal and install one screw. Tighten screw to 20 foot-pounds.

2. Rotate propeller shaft to gain access to remaining screw hole.

3. Install remaining screw. Tighten screw to 20 foot-pounds.

4. After both torsional damper screws have been installed, recheck torque on both screws. It may be necessary to tighten the first screw a little more to obtain the proper torque.

5. Lower car.

31. Universal Joint Cross

(NOTE: If both crosses are to be removed, perform this procedure first on slip yoke (or ball support yoke) cross, then repeat procedure for inner cross beginning with Step 5. Remove bearing cups from link yoke first.)

a. Removal

1. Remove propeller shaft from car as described in Note 28a. If working on 75 or Commercial, remove propeller shaft as described in Note 29a, then separate front and rear sections according to Note 36a.

2. Scribe or punch alignment marks on all yokes for proper orientation on reassembly, Fig. 4-29.

3. Support propeller shaft in horizontal position in line with base plate of press.

4. Place ordinary mechanics 1-1/4" socket on press, with open end facing upward.

(NOTE: A piece of pipe of equal dimensions can be used in place of 1-1/4" socket.)

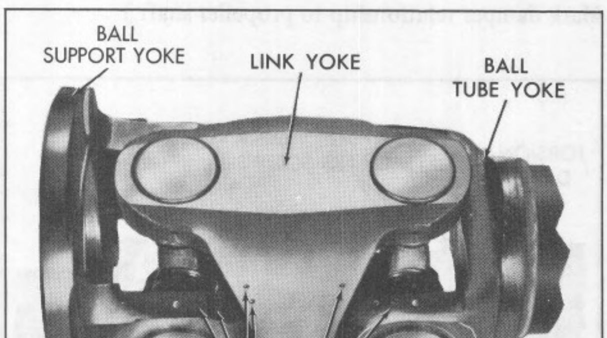


Fig. 4-29 Alignment Marks on Yokes

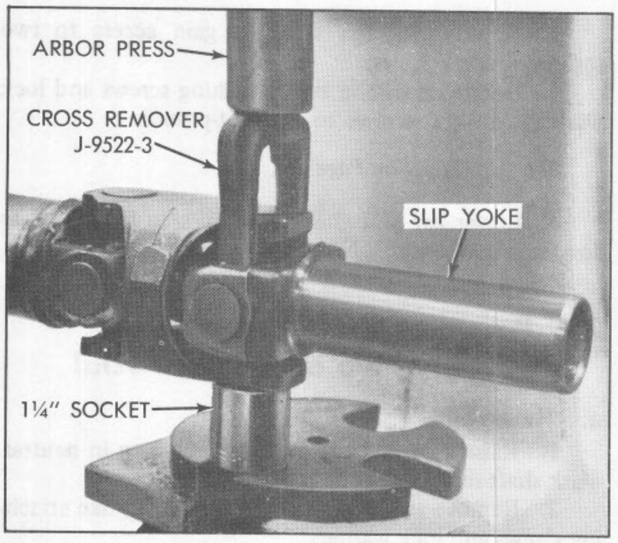


Fig. 4-30 Removing Bearing Cups

5. Position the appropriate ear of the link yoke over hole in socket.

6. If working on joint that has been serviced previously, remove snap rings from grooves in bearing cups.

7. Install Cross Remover, J-9522-3, over link yoke, engaging sides of bearing cups, Fig. 4-30. Use press to shear nylon injection of link yoke bearing cups and press bearing cup out of yoke as far as possible.

(NOTE: When press is operated, joint will angulate, causing opposite end of shaft to rise. This movement is necessary to remove bearing cups. Use other hand to support and guide shaft in its upward movement, and to lower shaft gently when press lever is released.)

8. Release press and remove Cross Remover, J-9522-3. Lift up on cross and position Spacer, J-9522-5, around lower journal, Fig. 4-31.

9. Position Cross Remover, J-9522-3, and continue pressing link yoke bearing cup from yoke.

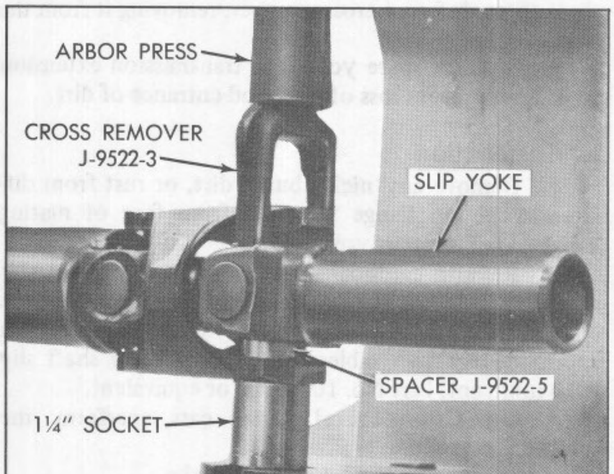


Fig. 4-31 Position of Spacer on Cross

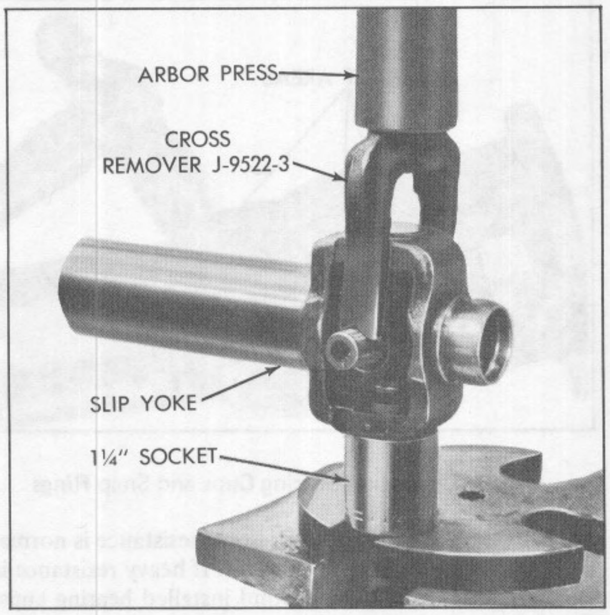


Fig. 4-32 Removing Cross

10. Repeat Steps 8 and 9 for other link yoke bearing cup.

11. Separate cross from link yoke, to gain access to centering ball.

12. Clean ball and examine thoroughly for rust, corrosion, distortion or excessive wear. If any of these conditions exist, replace ball and corresponding ball seat components. See Notes 34 and 35.

(NOTE: If ball does not need replacing, universal joint can be reassembled using a new service kit which contains two bearing cup assemblies, retainers and seals, and two snap rings. Follow Steps 7 thru 11 of the installation procedure.)

13. Position yoke and cross assembly on press and use Cross Remover, J-9522-3, to remove remaining bearing cups, Fig. 4-32.

(NOTE: Spacer, J-9522-5, is not necessary at this stage of procedure.)

b. Installation

Whenever a universal joint or bearing cup is removed, a service kit must be installed, as production universal joints have no snap ring grooves. Install only complete universal joint repair kits. Kits include a new cross, four bearing cup assemblies, retainers and seals, and four snap rings, Fig. 4-33.

1. Insert cross into yoke.
2. Insert one bearing cup assembly by hand.

CAUTION: Make certain all needles are properly seated in bearing cup. If any needles are missing or mispositioned, early failure will result.

3. Adjust position of cross so that one leg of cross is all the way into bearing. Make sure bearing is not cocked in yoke.
4. Maintain position of cross in bearing to keep needles seated, and firmly tap bearing cup into yoke, Fig. 4-34, until snap ring groove is exposed.
5. Install snap ring in groove in bearing cup, Fig. 4-35.
6. Repeat Steps 2 through 5 for opposite bearing assembly.

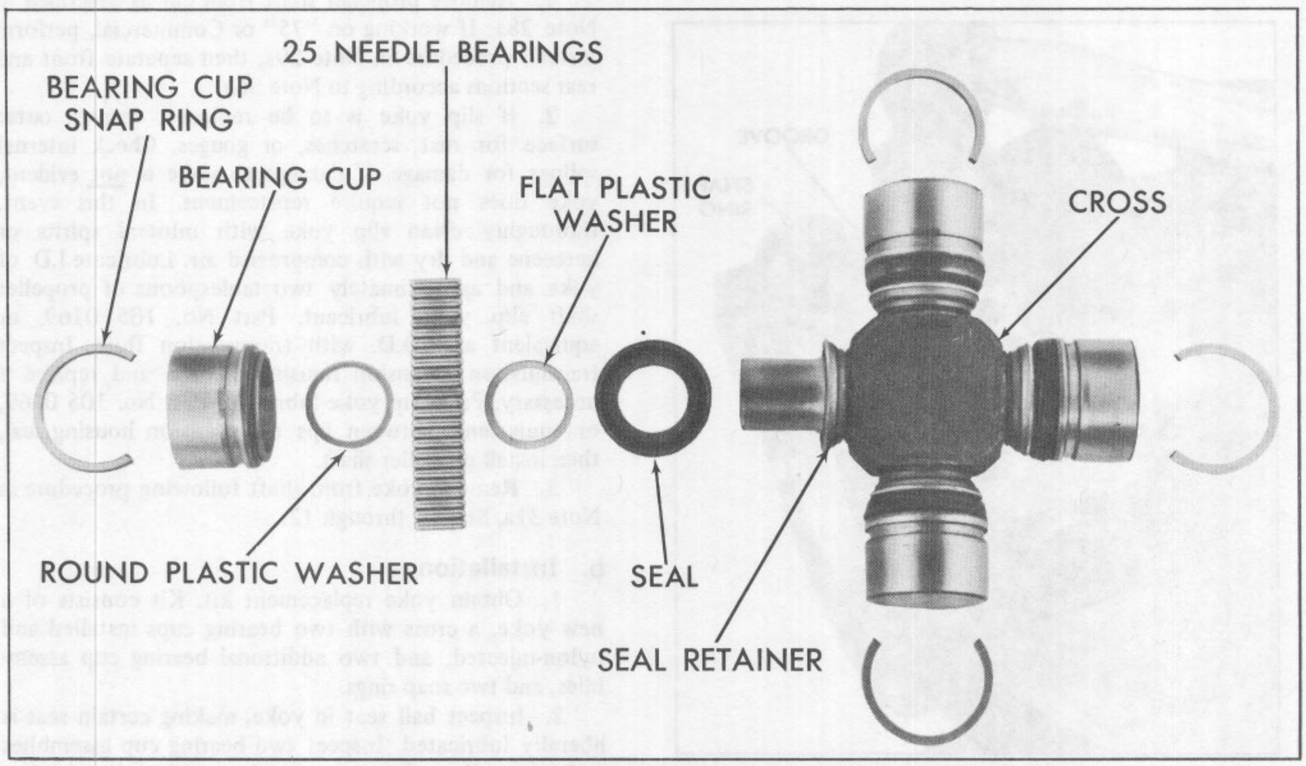


Fig. 4-33 Universal Joint Service Kit

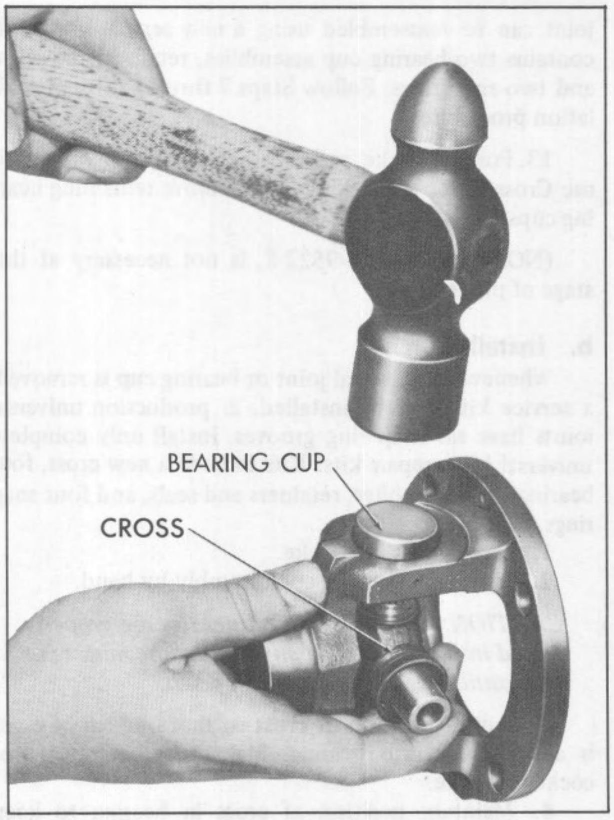


Fig. 4-34 Installing Bearing Cups

7. Position link yoke over yoke and cross assembly, observing alignment marks made on disassembly.

8. Repeat Steps 2 through 6 to install link yoke bearing cups.

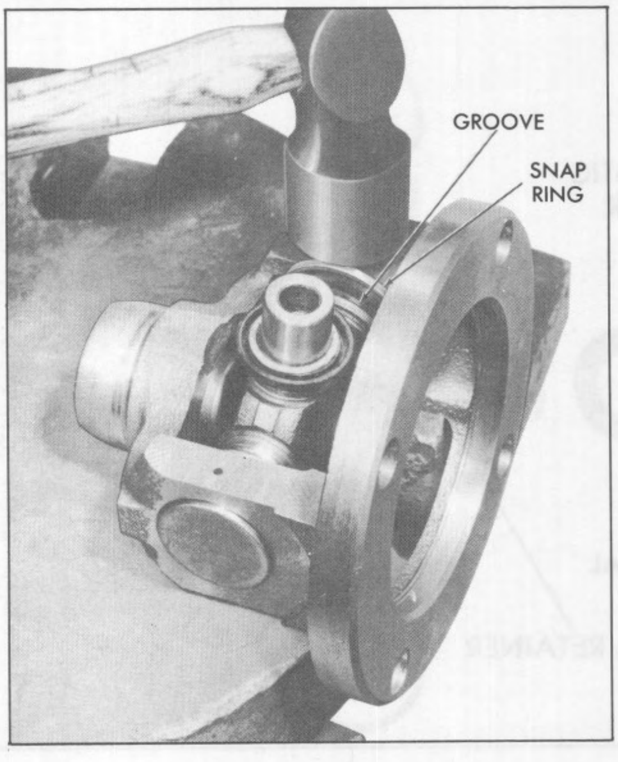


Fig. 4-35 Installing Snap Ring

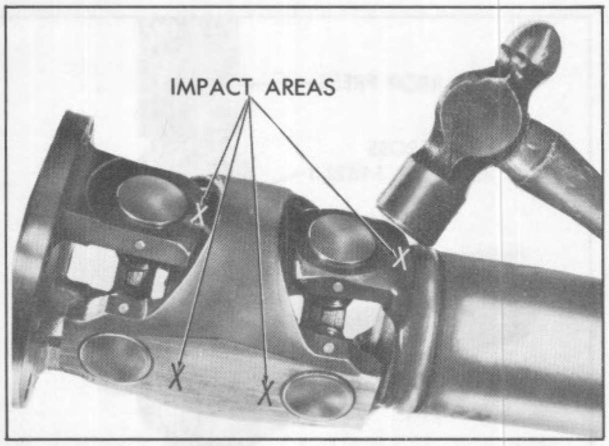


Fig. 4-36 Seating Bearing Cups and Snap Rings

9. Check cross for travel. Some resistance is normal and requires no furhter adjustment. If heavy resistance is encountered, strike yoke behind installed bearing cups, Fig. 4-36.

10. Install propeller shaft on car as outlined in Note 28b. If working on "75" or Commercial, assemble front and rear sections following procedures in Note 36b, then install shaft as is outlined in Note 26b.

11. Road test car. If propeller shaft unbalance condition is found, rebalance propeller shaft as outlined in Note 27.

32. Slip Yoke or Ball Support Yoke

a. Removal

1. Remove propeller shaft from car as described in Note 28a. If working on "75" or Commercial, perform instead procedure in Note 29a, then separate front and rear sections according to Note 36a.

2. If slip yoke is to be replaced, inspect outer surface for rust, scratches, or gouges. Check internal splines for damage. If damage to yoke is not evident, yoke does not require replacement. In this event, thoroughly clean slip yoke with mineral spirits or kerosene and dry with compressed air. Lubricate I.D. of yoke and approximately two tablespoons of propeller shaft slip yoke lubricant. Part No. 105 0169, or equivalent and O.D. with transmission fluid. Inspect transmission extension housing oil seal and replace if necessary. Pack slip yoke lubricant, Part No. 105 0169, or equivalent, between lips of extension housing seal, then install propeller shaft.

3. Remove yoke from shaft following procedure in Note 31a, Steps 1 through 12.

b. Installation

1. Obtain yoke replacement kit. Kit consists of a new yoke, a cross with two bearing cups installed and nylon-injected, and two additional bearing cup assemblies, and two snap rings.

2. Inspect ball seat in yoke, making certain seat is liberally lubricated. Inspect two bearing cup assemblies to be sure all needles are properly positioned and lubricated.

3. Position link yoke over cross and install bearing cups, observing procedure in Note 31b, Steps 2 through 6.

4. Install propeller shaft on car.

5. Rebalance shaft on car as described in Note 27.

33. Link Yoke

a. Removal

(NOTE: The link yoke can be replaced (serviced) without disassembly of the "U" joint from the tube yoke, support yoke or slip yoke.)

1. Perform procedure in Note 31a, Steps 1 through 12, to remove slip yoke (or support yoke) cross from link yoke and to inspect ball for damage.

2. Remove link yoke from inner cross by repeating Steps 5 through 10, Note 31a.

b. Installation

1. Obtain a new link yoke and either a kit with two bearing cup assemblies and two snap rings or a complete universal joint assembly as required.

2. Position link yoke on inner cross and install two bearing cup assemblies by following Note 31b, Steps 2 through 6.

3. Position slip yoke (or support yoke) cross in link yoke, orienting with tube yoke according to marks made on disassembly.

4. Repeat Steps 2 through 6, Note 31b to install remaining bearing cups.

5. Install propeller shaft.

6. Rebalance shaft on car as described in Note 27.

34. Propeller Shaft Centering Ball

a. Removal

1. To gain access to centering ball, perform Steps 1 through 12, Note 31a.

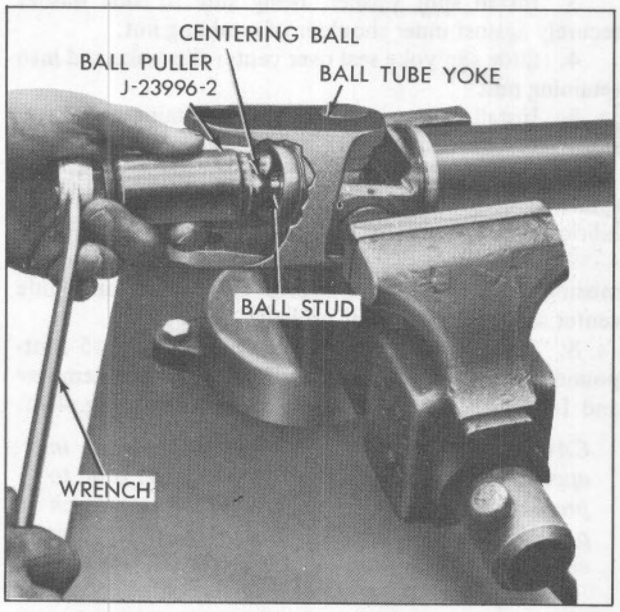


Fig. 4-37 Removing Centering Ball

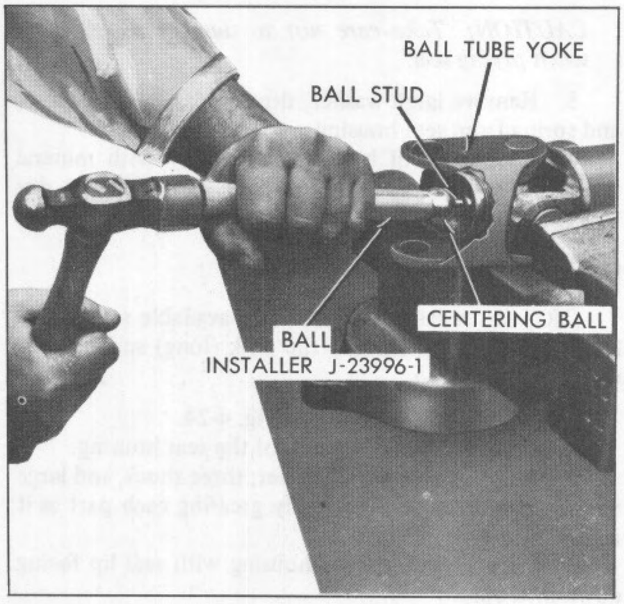


Fig. 4-38 Installing Centering Ball

2. Clamp shaft in bench vise as shown in Fig. 4-37 and install Ball Puller, J-23996-2, over ball. Tighten nut finger tight.

(NOTE: A light coat of multi-purpose grease applied to outer surface of jaws of ball puller tool, will reduce friction between jaws and inside surface of tool sleeve.)

3. Tighten nut until ball is removed from stud.

(NOTE: A ball and seat kit is available separately. It has two springs. Discard the pink (long) spring when used on a Cadillac.)

b. Installation

1. Position new ball on stud.

2. Position Ball Installer Tool, J-23996-1, against ball and drive with hammer, Fig. 4-38, until ball bottoms on stud.

3. Re-assemble and re-install shaft using Steps 1 through 11, Note 31b.

35. Ball Seat Assembly (Fig. 4-24)

a. Disassembly

1. Remove propeller shaft from car, Note 29a.

2. Remove slip yoke (or ball support yoke) from shaft to gain access to centering ball, following Note 31a, Steps 1 through 12.

3. Clean ball and examine thoroughly for rust, corrosion, distortion or excessive wear. If any of these conditions exist, replace ball and corresponding ball seat components.

(NOTE: If ball does not need replacing, universal joint can be reassembled using a new service kit which contains two bearing cup assemblies, retainers and seals, and two snap rings. Follow Note 31b, Steps 7 through 11.)

4. Pry grease seal from ball seat housing.

CAUTION: Take care not to damage seal bore when prying seal.

5. Remove large washer, three shoes, small washer, and spring from seat housing.

6. Wash bore of housing thoroughly with mineral spirits to remove all traces of old lubricant and dry thoroughly with compressed air.

b. Assembly

(NOTE: A ball and seat kit is available separately. It has two springs. Discard the pink (long) spring when used on a Cadillac.)

1. Obtain ball and seat kit, Fig. 4-24.
2. Liberally grease the I.D. of the seat housing.
3. Insert spring, small washer, three shoes, and large washer into housing, thoroughly greasing each part as it is inserted.
4. Place grease seal on housing with seal lip facing down into bore.
5. Place Seal Installer, J-23694, over seal and tap seal into place, Fig. 4-39. Seal is installed when flush with housing.
6. Pack remaining grease in seat assembly and on seal. Make sure inner surfaces of shoes are liberally lubricated.
7. Position yoke and cross assembly in link yoke and install bearing cups, observing procedure in Note 31b, Steps 2 through 6.
8. Install propeller shaft, Note 29b.
9. Rebalance shaft on car as described in Note 27.

36. Front Section—Seventy-Five and Commercial

a. Disassembly

1. Remove propeller shaft assembly as described in Note 29a.

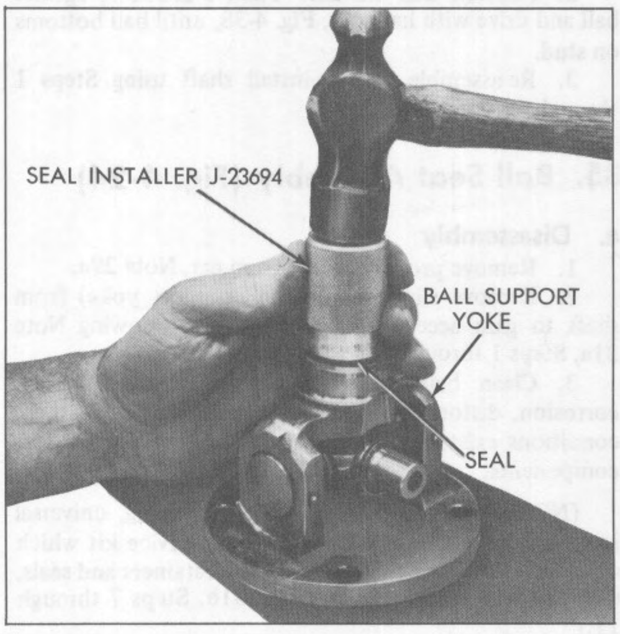


Fig. 4-39 Installing Ball Support Yoke Seal

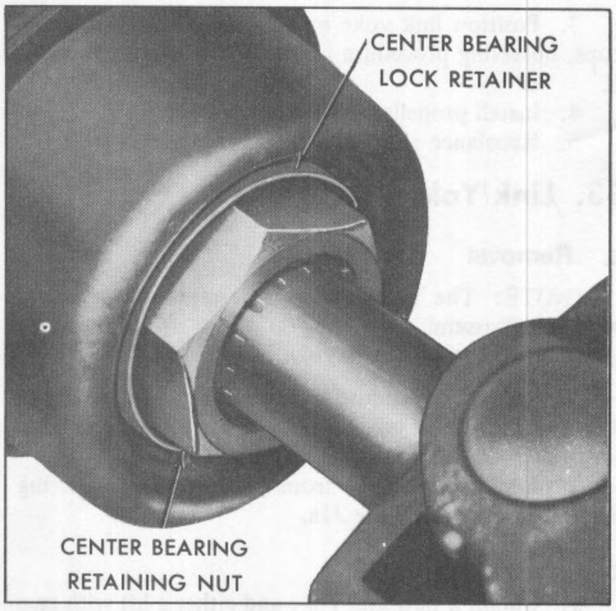


Fig. 4-40 Propeller Shaft Retainer

2. Pry up center bearing lock retainer, Fig. 4-40.
3. Back off center bearing retaining nut, using Center Bearing Retaining Nut Remover and Installer, J-21009, and separate front and rear propeller shafts by sliding front shaft off center slip yoke.
4. Remove and discard center bearing lock retainer if damaged.
5. Remove center slip yoke seal, split washer, and center bearing retaining nut from slip yoke. Inspect for damage or excessive wear.

b. Assembly

1. Clean spline of center slip yoke.
2. Install center bearing retaining nut on slip yoke with threaded end toward front propeller shaft.
3. Install split washer, being sure to slide washer securely against inner shoulder of retaining nut.
4. Slide slip yoke seal over center slip yoke and into retaining nut.
5. Install new center bearing lock retainer on center slip yoke.
6. Coat inner spline of front propeller shaft and spline of center slip yoke with center bearing slip yoke lubricant, Part No. 1050191, or equivalent.
7. Align wire clip on end of center slip yoke with missing land on inner spline of front shaft and slide center slip yoke into front propeller shaft spline.
8. Tighten center bearing retaining nut to 55 foot-pounds using Center Bearing Retaining Nut Remover and Installer, J-21009, and a torque wrench. Fig. 4-41.

CAUTION: Particular care should be taken in application of torque wrench and installer tool, to prevent over-torquing the nut. Hold torque wrench perpendicular to installer tool to cancel off-set error on torque reading.

9. Bend edge of center bearing lock retainer in two places to lock center bearing retaining nut.

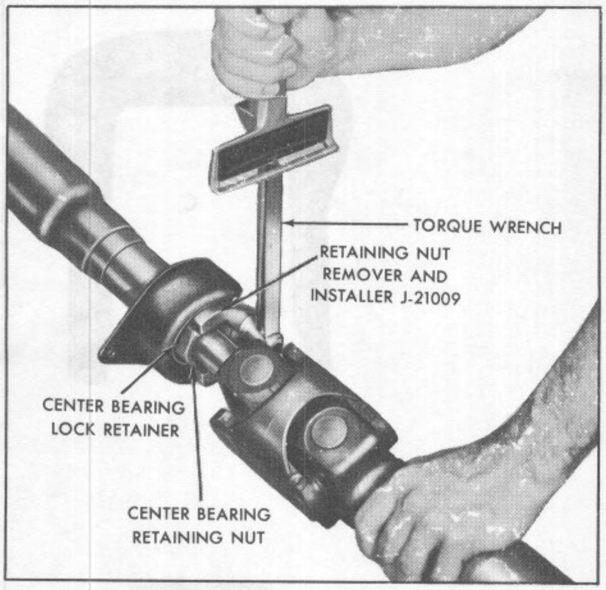


Fig. 4-41 Tightening Center Bearing Retaining Nut

10. Install propeller shaft assembly as described in Note 29b.

37. Center Bearing—Seventy-Five and Commercial

a. Removal

1. Remove propeller shaft assembly as described in Note 29a.

2. Disassemble front and rear propeller shafts as described in Note 36a.

3. Remove center bearing support and bracket assembly from front propeller shaft by tapping on front side of assembly with a soft head hammer or through a block of wood.

4. Remove slinger from end of propeller shaft.

5. Pry out snap ring from open side of bearing retainer and remove bearing from support bracket by tapping lightly from rear with a soft head hammer, or through a block of wood.

b. Installation

1. Install bearing into bearing retainer, pressing on outer race of bearing only. Use care not to damage bearing or support. Secure bearing in retainer with snap ring.

2. Pack front and rear face of center bearing with artic #5 grease or other heavy duty lubricant, such as water pump grease.

3. Install slinger on front propeller shaft.

4. Position center bearing support assembly on rear of front propeller shaft with snap ring facing rear end of shaft.

(It may be necessary to tap alternately on inner race of bearing with a brass drift to permit clearance for installing retaining nut.)

5. Assemble front and rear propeller shafts as described in Note 36b.

6. Install propeller shaft assembly as described in Note 29b.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16-20	70*
Special	Propeller Shaft Center Bearing Retaining Nut ("75" and Commercial)	1-9/16-18	55
300-M	Center Bearing Support Bolts ("75" and Commercial)	5/16-18	25
300-M (Special)	Propeller Shaft Torsional Damper Screws .	5/16-18	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.			

***CAUTION:** *This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

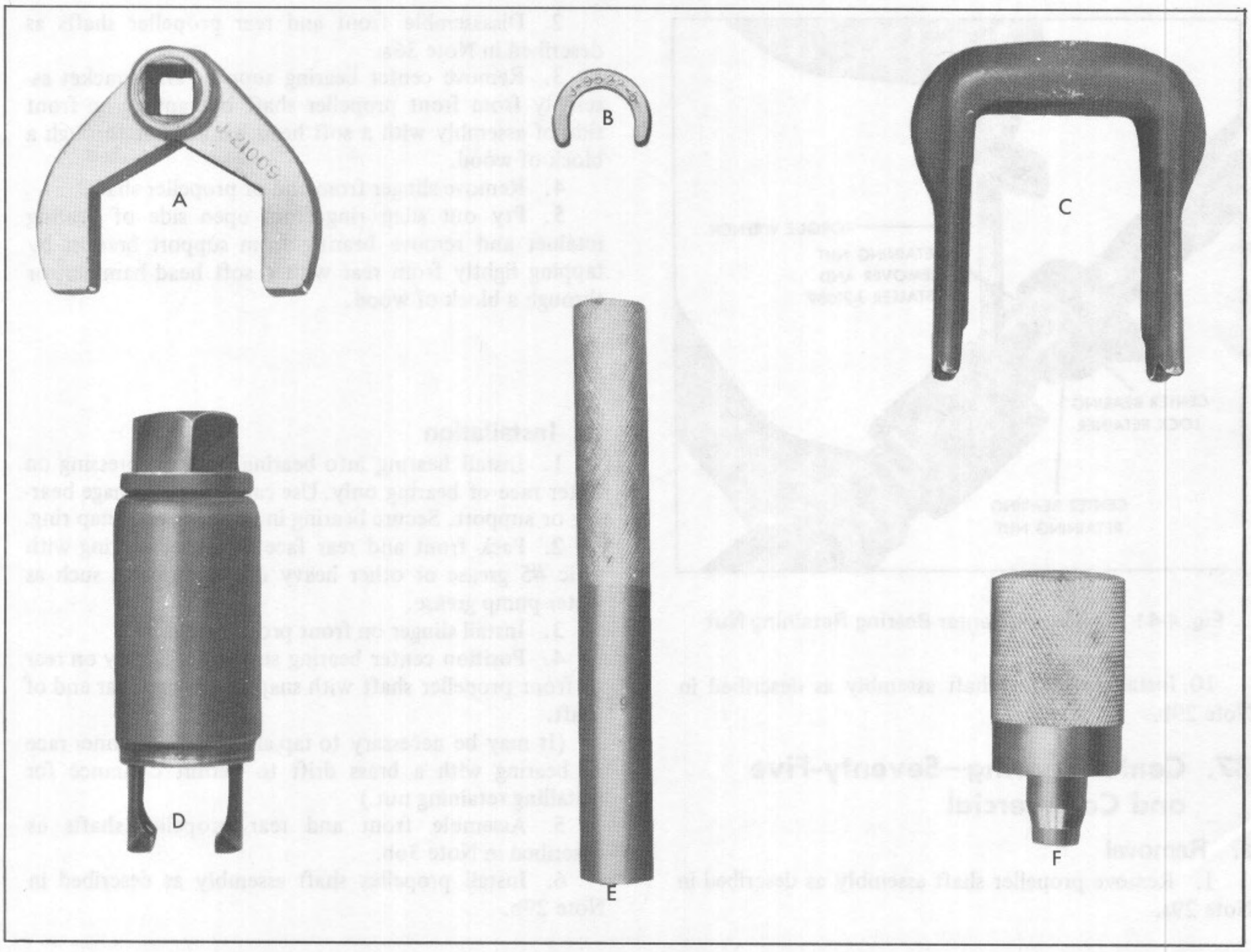


Fig. 4-42 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21009	Center Bearing Retaining Nut Remover and Installer	D	J-23996-2	Ball Puller Tool
			E	J-23996-1	Ball Installer Tool
B	J-9522-5	Spacer	F	J-23694	Ball Seat Seal Installer
C	J-9522-3	Cross Remover			

DIAGNOSIS

Bearing Failure Conditions

Whenever a front or rear wheel bearing or a pinion or differential bearing is removed, a careful inspection must be made to determine the cause of failure and whether any related parts have been damaged.

Before diagnosing a bearing problem, clean the cone assembly thoroughly in solvent and allow to dry completely.

(NOTE: If bearing has become magnetized, removal of metal particles from inside cage cannot be accomplished unless bearing is demagnetized.)

Compare bearing in question to the examples in Fig. 4-43 then refer to the corresponding explanation on this page and follow recommendations to prevent a similar failure in the replacement bearing.

Wear

Bearing lubricant is contaminated by fine particles of some abrasive material. The finish on the rollers and outer race has become dulled in uniform pattern. If wear is very minor the bearing need not be replaced.

Cage Wear

This is a more advanced case of wear in which even the roller cage has been affected. Unit must be replaced.

Step Wear

A different kind of wear pattern, affecting only the ends of the rollers, could develop from contaminated lubricant. If bearing is already rough or noisy it must be replaced. In any case, do not preload beyond specification on installation.

Indentations

Surface depressions or pits in the races or rollers are caused by hard particles of foreign material. If condition is at least as advanced as that shown in the example, discard bearing and outer race.

Regardless of whether or not replacement is necessary, if any bearing shows signs of indentation or of wear on race, rollers, or cage, the lubricant must be completely removed from the bearing assembly and all associated parts before refilling or repacking. All seals must be examined very carefully for damage that could admit contaminants. If these precautions are not followed, an identical failure could result.

Misalignment

The roller and cage assembly in this example is cocked with respect to the outer race. Check for small burrs or foreign material lodged between bearing and outer race or between race and housing. These surfaces must be absolutely smooth to prevent this type of failure.

Cracked Inner Race

When the press fit is at the inner race, a cocked assembly will result in a cracked inner race. This type of failure can be caused by improper removal and installation techniques. Always use the recommended tools when servicing bearings.

Fretting

"Fretting" is the term used to describe corrosion resulting from slight relative movement of parts with no coating of lubricant. Check and clean all related parts during the replacement procedure as these could also be damaged.

Stain Discoloration

Lubricant breakdown can leave brown or black stains. In this case, the unit is not necessarily defective. If light polishing removes the stain, the bearing can be reused.

Heat Discoloration

An overload on the bearing or deterioration of the lubricant will result in discoloration different from stain discoloration, although the two can be confused.

Stains ranging in color from faint yellow to dark blue indicate the possibility of softening of races or rollers. Draw a file across the discolored areas. If the file cuts metal, discard the bearing. If it glides readily over the affected parts, the bearing can be reused.

Galling

Metal smears on roller ends render bearings unusable. When installing new bearing, be certain that bearing is properly adjusted and that correct lubricant is used. Conduct a very careful examination of seals. This condition is easily caused when lubricant is allowed to escape.

Bent Cage

This kind of damage results from simple mishandling. Bearings are very vulnerable to forces other than those that they were designed to handle. A dent even as minor as the one pictured will ruin a bearing.

Always use a piece of cardboard or other soft covering on workbench when handling bearing parts.

Brinelling

A severe impact on a bearing or vibration while the unit is not rotating causes the rollers to dent the race surface. Often, this condition is related to extraneous circumstances (such as a collision) rather than a defect in the vehicle.

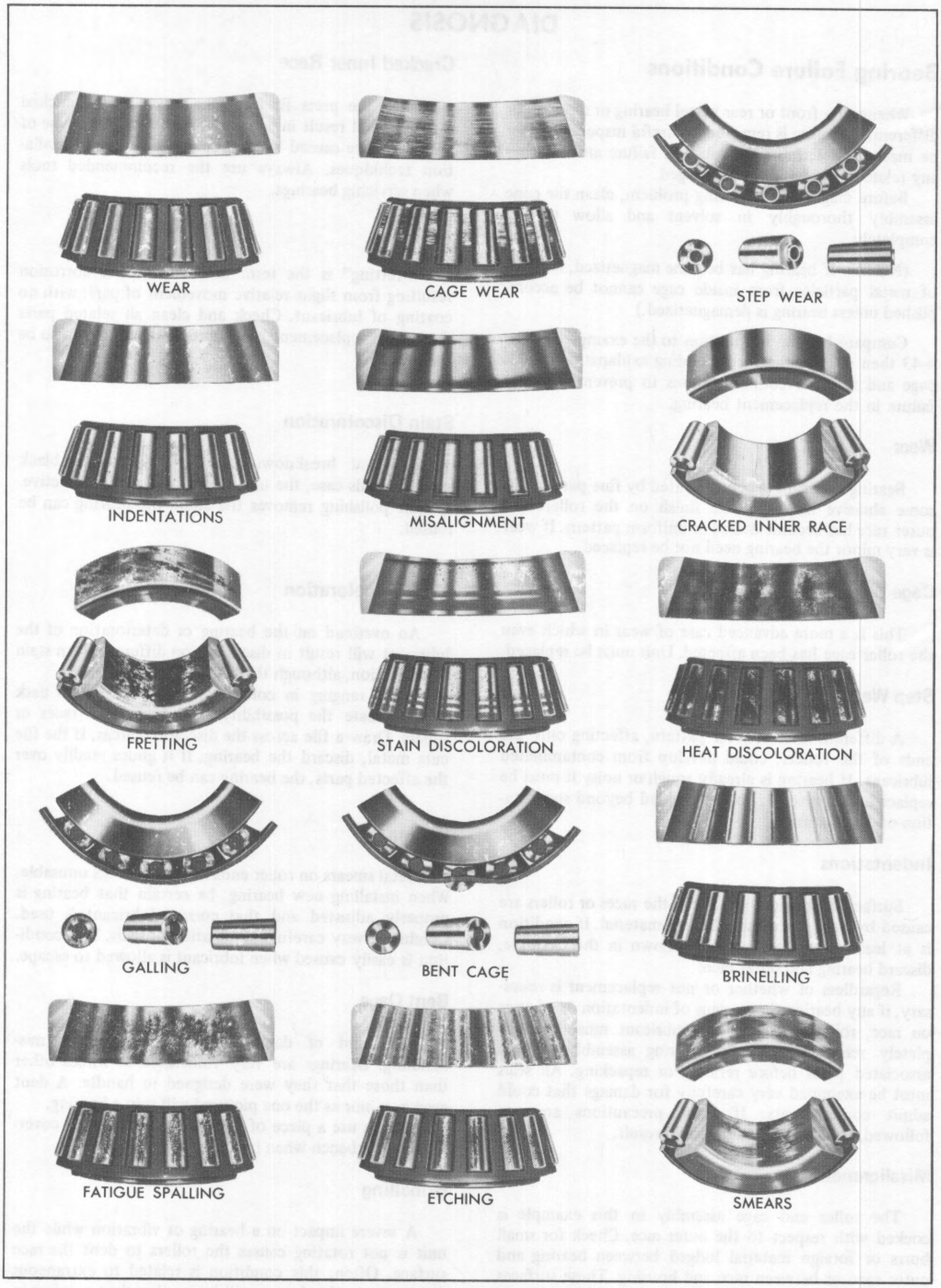


Fig. 4-43 Bearing Failure Conditions

Fatigue Spalling

Fatigue spalling is the flaking of metal from bearing surfaces. These particles can cause further damage when car is back in service. Remove all lubricant and clean all related parts completely before reassembly with replacement bearing.

Etching

Bearing appears gray or grayish black and there is some erosion of surface metal of the race at the same spacing as the rollers. As in other cases in which hard particles have contaminated the lubricant, clean all parts thoroughly to prevent future damage. Check seals.

Smears

Smearing of metal can occur on any or all of the bearing surfaces. this is generally due to the overheating related to the unwanted slippage between parts, and this slippage generally stems from either a loose fit, poor lubricant, or an overload on the unit. When installing new bearing, make certain proper amount of correct lubricant is used and that bearing is adjusted to specification.

GENERAL DESCRIPTION

(NOTE: Rear axle service information pertaining to the Eldorado is covered at the back of this section beginning on Page 4-41.)

The rear axle housing used on all Cadillac cars except the Eldorado consists of a nodular cast iron center section that houses the ring and pinion gear set and the differential. In addition to the center section, there are two tube and bracket assemblies that are pressed into the center section and welded in place.

The housing incorporates attaching brackets for the rear springs, upper and lower control arms, and shock absorbers. The axle housing has a vent fitting on the left side to relieve internal pressure.

The Commercial Chassis uses two spring pads in place of the two spring attaching brackets for attaching the leaf springs.

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

38. Rear Axle Backlash Measurement

1. Place car on hoist.
2. Disconnect propeller shaft as described in Note 28a.
3. Install Spacers, J-21044-5, over unthreaded holes of pinion flange.
4. Install Pinion Flange Holding Tool, J-8614-1, on spacers with raised side of tool against spacers and secure with two bolts and nuts.
5. Secure holding tool to lower control arm to prevent rotation of pinion flange.
6. Pull parking brake cable on one wheel to prevent wheel from turning. (This is not necessary on cars equipped with a Controlled Differential).
7. Measure rotation (backlash) of opposite wheel in inches of outer circumference of tire tread. A stiff wire pointer fastened to the fender or car frame will aid in this measurement. Maximum backlash under this condition should not exceed 1/2 inch on standard differentials and 1/8 inch on Controlled Differentials.

39. Rear Wheel and Brake Drum

a. Removal

1. Remove rear wheel shield and wheel disc.
2. Loosen wheel mounting nuts.
3. Raise rear end of car and place jack stands under rear frame rails.
4. Remove wheel mounting nuts and remove wheel. (Remove wheel spacer on Commercial series vehicles.)
5. Remove push nut securing brake drum to axle shaft flange. (Push nut is not used on Commercial series cars.)
6. Remove brake drum.

b. Installation

1. Install brake drum.
2. Install one push nut securing brake drum to axle shaft flange, except on Commercial series vehicles. (Install wheel spacer on Commercial series vehicles.)
3. Install wheel and replace wheel mounting nuts.
4. Remove jack stands, lower car, and tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

5. Install wheel disc and wheel shield.

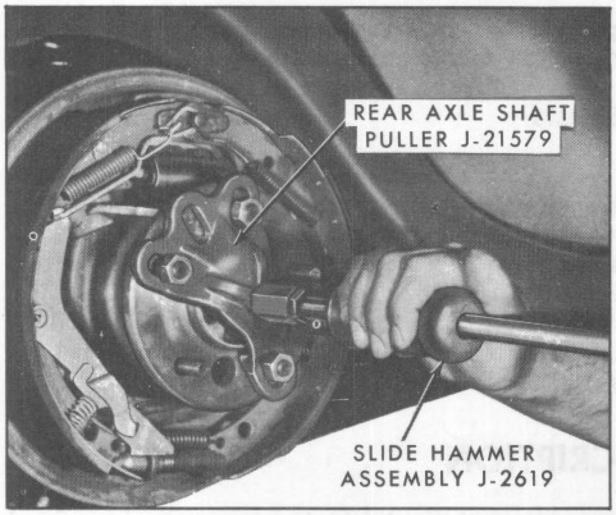


Fig. 4-44 Removing Rear Axle Shaft

40. Axle Shaft Bearing Oil Seal, and Wheel Bearing

a. Removal of Axle Shaft and Bearing Assembly

1. Raise rear end of car and remove wheel and brake drum as described in Note 39a.

2. Remove four nuts that secure retainer and backing plate to rear axle housing.

3. Attach Slide Hammer, J-2619, to Axle Shaft Puller, J-21579, using Adapter, J-2619-4.

4. Install Axle Shaft Puller, J-21579, on studs of rear axle shaft flange, Fig. 4-44.

5. Drive outward with slide hammer and remove axle shaft.

(NOTE: The tapered roller unit type rear wheel bearing, when new, is bonded together to facilitate installation. If tapered roller unit bearing is used, the bearing may separate when removing the axle shaft, leaving the outer race in the axle housing. This is a normal condition and does not indicate failure. If the bearing is to be replaced, make sure the old bearing outer race is removed from the housing before installing a new bearing.)

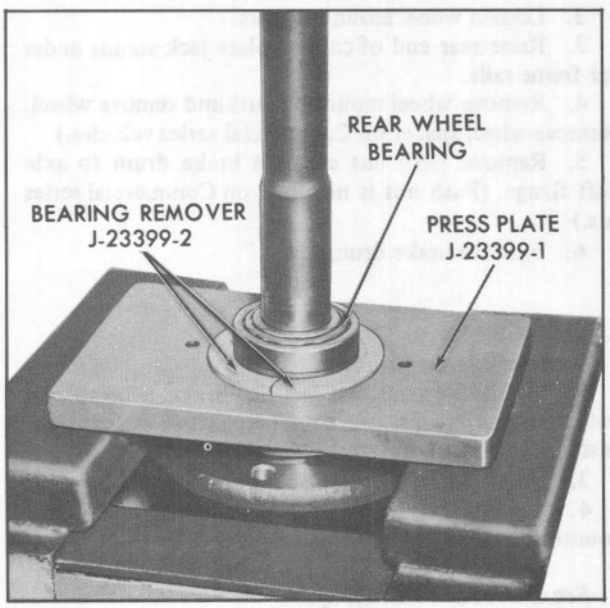


Fig. 4-45 Removing Rear Wheel Bearing

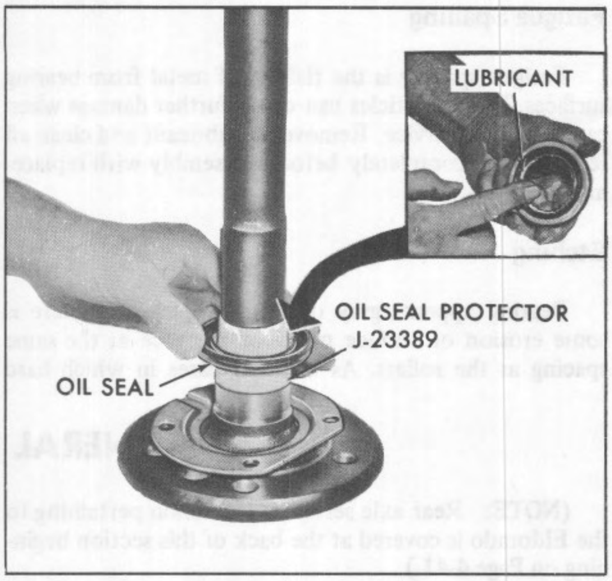


Fig. 4-46 Installing Rear Wheel Oil Seal

b. Removing Rear Wheel Bearing and Oil Seal

1. Using a cold chisel and hammer, split bearing retainer next to bearing, being careful not to damage bearing or shaft.

(NOTE: Bearing retainer must be completely split. Drive chisel into retainer until retainer separates, then remove and discard retainer.)

2. Stand axle shaft upright on flanged end. Using two screwdrivers, pry oil seal away from wheel bearing.

3. Slide Press Plate, J-23399-1, over axle shaft and into position between bearing and bearing retainer, Fig. 4-45.

4. Install both halves of Bearing Puller, J-23399-2 (J-23399-3 for "75" and Commercial Series) into Press Plate, J-23399-1, Fig. 4-45.

5. Position axle shaft and Press Plate in press and press bearing off axle shaft.

CAUTION: Make certain that axle shaft is properly centered in press so that axle shaft flange does not catch on side of press and become damaged.

6. Remove axle shaft from press.

7. Slide bearing, seal, and bearing puller tools up and off axle shaft.

8. Slide cover up and off axle shaft.

c. Installing Rear Wheel Bearing and Oil Seal

1. Wipe axle shaft and bearing clean.

2. Install bearing cover on axle shaft with raised side of cover against axle shaft flange, Fig. 4-46.

3. Install Seal Protector, J-23389, on axle shaft with small end of protector pointing toward splined end of axle shaft, Fig. 4-46.
4. Lubricate lip of new oil seal with wheel bearing grease.
5. Install oil seal by gently pressing seal down over Seal Protector, J-23389. The oil seal is properly installed when the lip of the seal clears the large end of the seal protector.

(NOTE: When installing oil seal on "75" and Commercial series vehicle, use Seal Protector, J-23391.)

6. Apply a light coat of wheel bearing grease on bearing.
7. If tapered roller unit bearing is used, position bearing on axle shaft with narrow ring of bearing facing flanged end of axle shaft. If straight roller bearing is to be installed, loose ring at one end of inner race must be installed toward the flange.
8. Position Bearing Installer, J-6257, on shaft and place axle shaft on press, making certain that axle shaft is properly centered in bearing installer, Fig. 4-47.
9. Press bearing on axle shaft until bearing bottoms against shoulder on shaft.
10. Remove Bearing Installer, J-6257, and position retainer on axle shaft.
11. Position Bearing Installer, J-6257, on shaft and place axle shaft on press, making certain that axle shaft is properly centered in bearing installer.
12. Press retainer on axle shaft until retainer bottoms against bearing.
13. Remove Bearing Installer, J-6257, from axle shaft.

d. Installing Axle Shaft and Bearing Assembly

(NOTE: If rear wheel bearing has been removed because of failure, inspect axle housing and differential carrier for metal chips and clean thoroughly.)

1. Apply a thin film of wheel bearing grease to wheel bearing bore in axle housing after checking housing for nicks and burrs.
2. Lubricate oil seal and outer race of bearing with wheel bearing grease.

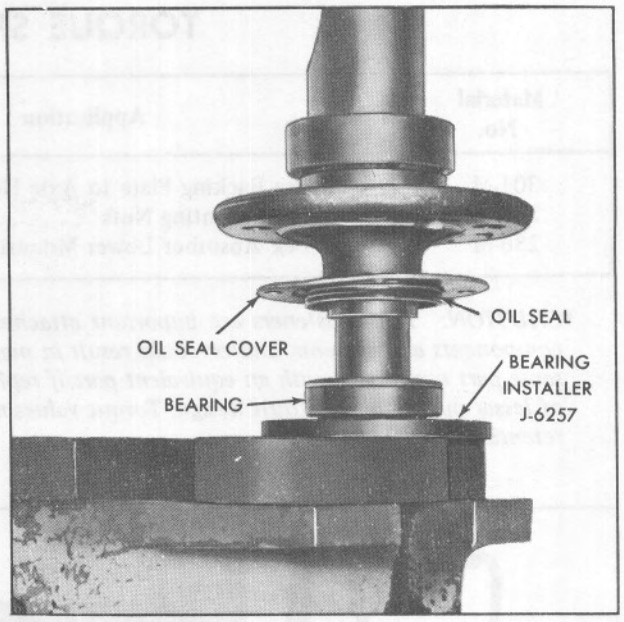


Fig. 4-47 Installing Rear Wheel Bearing

3. Install new gasket on brake backing plate.
4. Install axle shaft into axle housing, using extreme care to align oil seal cover with axle housing mounting bolts.

(NOTE: It may be necessary to rotate axle shaft to permit axle shaft splines to engage differential side gear splines.)

5. Install four nuts on axle housing flange bolts to hold gasket, brake backing plate, and oil seal cover in place. Tighten nuts to 50 foot-pounds by inserting a socket wrench through large holes in rear axle shaft flange.
6. Install brake drum and one push nut.
7. Install wheel and lower car. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

8. Install wheel disc and wheel shield.

SPECIFICATIONS

Series	Brg. Bore Diameter	Axle Shaft Length Lefthand	Axle Shaft Length Righthand
All Except Seventy-Five and Commercial			
Std. Diff.	1.564	28.50	34.02
Contr. Diff.	1.564	27.71	34.81
Seventy-Five and Commercial			
Std. Diff.	1.773	28.50	34.02
Contr. Diff.	1.773	27.71	34.81

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
301-M	Brake Backing Plate to Axle Housing Nuts . .	7/16-14	50*
286-M	Wheel Mounting Nuts	1/2-20	130*
286-M	Shock Absorber Lower Mounting Nut	1/2-20	50

***CAUTION:** *These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

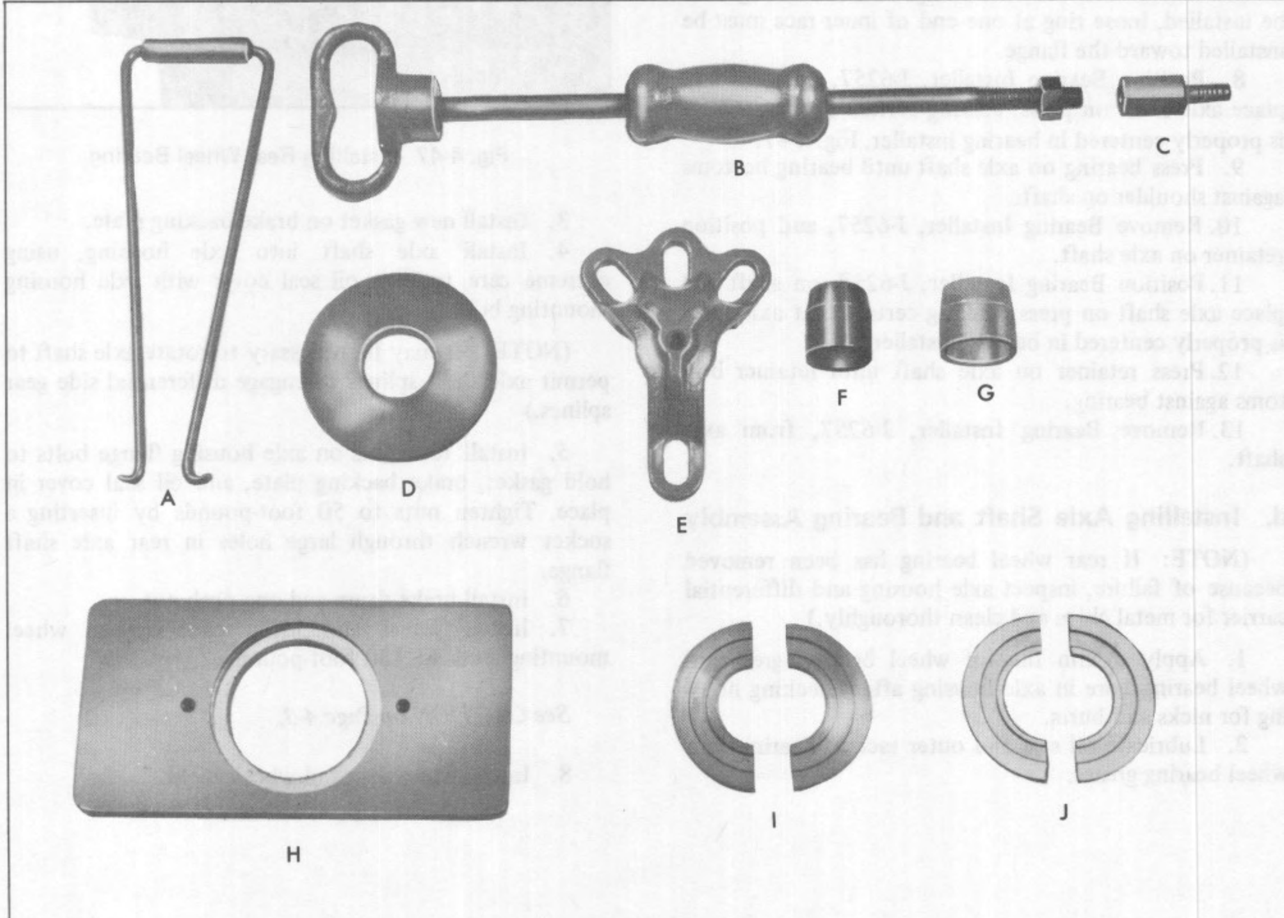


Fig. 4-48 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-943	Bearing Cup Remover	G	J-23391	Axle Shaft Seal Protector (Except Std. and Eldorado)
B	J-2619	Slide Hammer	H	J-23399-1	Axle Bearing Press Plate
C	J-2619-4	Adapter	I	J-23399-2	Bearing Remover (Standard Car)
D	J-6257	Rear Wheel Bearing Installer	J	J-23399-3	Bearing Remover(Except Standard Car)
E	J-21579	Rear Axle Shaft Puller			
F	J-23389	Axle Shaft Seal Protector (Standard Car)			

GENERAL DESCRIPTION

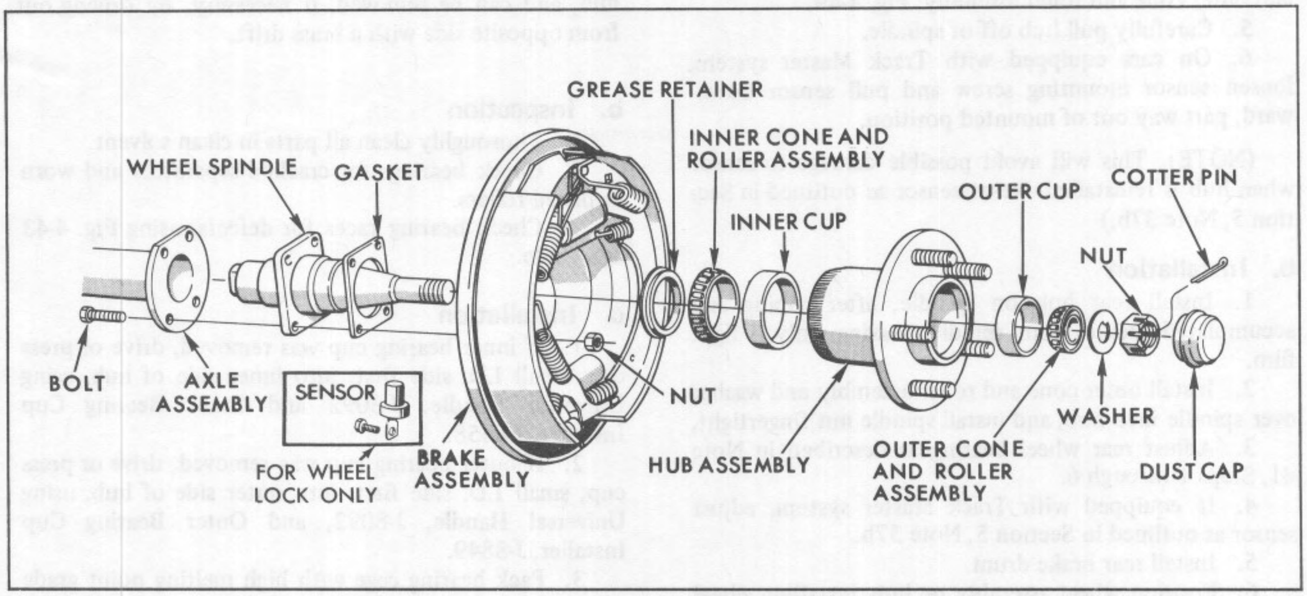


Fig. 4-49 Rear Wheel Disassembled – Eldorado

The rear axle used on the Eldorado is a straight, hollow tube, Fig. 4-49. The rear wheel spindles are pressed into and bolted to the axle tube assembly. On cars equipped with Track Master system, speed sensors are attached to each rear brake backing plate and the wiring harness is routed across the top of the axle.

Tapered roller bearings are used in the rear hubs. For diagnosis information pertaining to this type of bearing, refer to Fig. 4-43 and the corresponding text.

SERVICE INFORMATION

The following service information pertains only to the Eldorado rear axle. For service procedures not given, refer to the forward portion of the appropriate sub-section as the procedures are the same as on other Cadillacs.

CAUTION: If any mispositioning incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

41. Rear Wheel Bearing Adjustment

Regularly scheduled rear wheel bearing repacking is not required. When major brake service is being performed, however, it is recommended that the rear wheel bearings be cleaned and repacked with a high melting point grade 2 lithium grease.

Adjustment of the rear wheel bearings should be made while revolving the wheel at least three times the speed of nut rotation when taking the torque readings.

1. While rotating hub assembly, tighten spindle nut to 25-30 foot-pounds.
2. Back nut off 1/2 turn, then retighten nut to 2 foot-pounds and install cotter pin.
3. If cotter pin cannot be installed in either of the two available holes in the spindle, with the nut at 2 foot-pounds, back nut off until cotter pin can be installed.
4. The rear hub must be rotated at least three revolutions during tightening of spindle nut. The final adjustment to be 2 foot-pounds nut torque to .004 bearing end play.
5. Peen end of cotter pin over sufficiently against side of nut. Cotter pin must be tight after installation. If it can be moved with finger, vibration may cause it to wear and break.
6. Install dust cap.

42. Rear Hub

a. Removal

1. Remove wheel shield, wheel disc and loosen wheel mounting nuts.
2. Raise rear end of car.
3. Remove wheel and tire assembly and brake drum.

4. Remove dust cap, cotter pin, spindle nut, washer and outer cone and roller assembly, Fig. 4-49.

5. Carefully pull hub off of spindle.

6. On cars equipped with Track Master system, loosen sensor mounting screw and pull sensor downward, part way out of mounted position.

(NOTE: This will avoid possible damage to sensor when hub is reinstalled. Reset sensor as outlined in Section 5, Note 37b.)

b. Installation

1. Install rear hub on spindle, after wiping any accumulated grease from spindle, leaving only a light film.

2. Install outer cone and roller assembly and washer over spindle into hub, and install spindle nut fingertight.

3. Adjust rear wheel bearing as described in Note 41, Steps 1 through 6.

4. If equipped with Track Master system, adjust sensor as outlined in Section 5, Note 37b.

5. Install rear brake drum.

6. Position wheel assembly on hub, installing wheel mounting nuts finger tight.

7. Lower car.

8. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

43. Rear Wheel Bearings and Grease Retainer (Fig. 4-49)

a. Removal

1. Remove hub assembly as described in Note 42.

2. Pry grease retainer from inner side of hub.

(NOTE: The inner bearing grease retainer tool, Section 3, Fig. 3-31, may be used to remove the grease retainer.)

3. Remove inner cone and roller assembly from hub.

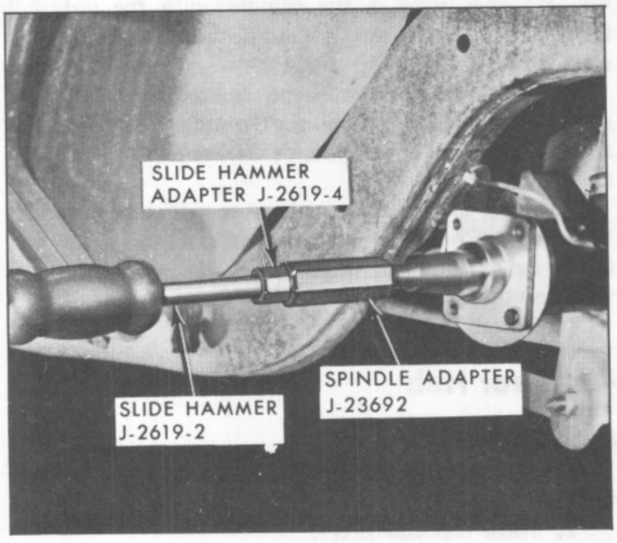


Fig. 4-50 Removing and Installing Rear Wheel Spindle

4. Inner and outer bearing cups are press fitted in hub, and can be removed, if necessary, by driving out from opposite side with a brass drift.

b. Inspection

1. Thoroughly clean all parts in clean solvent.

2. Check bearings for cracked separators and worn or pitted rollers.

3. Check bearing races for defects, using Fig. 4-43 as a guide.

c. Installation

1. If inner bearing cup was removed, drive or press cup, small I.D. side first, into inner side of hub, using Universal Handle, J-8092 and Inner Bearing Cup Installer, J-8458.

2. If outer bearing cup was removed, drive or press cup, small I.D. side first, into outer side of hub, using Universal Handle, J-8092, and Outer Bearing Cup Installer, J-8849.

3. Pack bearing cage with high melting point grade 2 lithium grease. Use a commercial bearing packer or pack bearings by hand, forcing grease in at large end of cage until it protrudes from the small end.

4. Install inner cone and roller assembly into inner side of hub.

5. Drive or press new grease retainer into inner side of hub, using Universal Handle, J-8092, screwed into a flat sided tool, such as J-23114.

(NOTE: If J-23114 is used, screw Universal Handle into reverse side of tool.)

6. Wipe spindle clean and apply a thin film of wheel bearing grease to spindle.

7. Install rear hub as described in Note 42b.

44. Rear Wheel Spindle—On Car

a. Removal

1. Raise rear of car.

2. Remove rear hub as described in Note 42a.

3. Disconnect brake line fitting at wheel cylinder.

4. Remove four nuts securing brake backing plate to spindle.

5. Remove brake backing plate from wheel spindle and place backing plate out of the way.

CAUTION: Do not let backing plate hang unsupported, as parking brake cable or sensor wiring harness could be damaged.

6. Start one brake backing plate to spindle nut just far enough to engage threads.

7. Attach Adapter, J-2619-4, to Slide Hammer, J-2619, and attach Spindle Adapter J-23692 to Adapter J-2619-4, and install assembly on spindle, Fig. 4-50.

(NOTE: Make sure all threads are fully seated.)

8. Use slide hammer assembly to drive spindle from axle.

9. Remove remaining spindle to backing plate bolt and nut and remove spindle.

10. Remove slide hammer assembly from spindle.

b. Installation

(NOTE: If spindle threads were damaged on removal, use a 3/4"-20 thread chaser to correct damage.)

1. Attach slide hammer assembly to new spindle, making sure threads are fully seated.
2. Drive new spindle into axle until spindle is fully installed, Fig. 4-50.
3. Install new gasket on wheel spindle.
4. Install brake backing plate on spindle and secure with four attaching nuts, tightening nuts to 40 foot-pounds.
5. Connect brake line fitting to wheel cylinder, tightening fitting to 14 foot-pounds.
6. Install rear hub as described in Note 42b.
7. Bleed brakes, Section 5, Note 6.

45. Rear Axle

a. Removal

1. Remove wheel shields, wheel discs, and loosen wheel mounting nuts.
2. Raise car on hoist and place jack stands under frame side rails.
3. Lower hoist and remove stabilizer bar as described in Note 12a.
4. Raise hoist just enough to support weight of axle (about 3/8").
5. Remove wheel mounting nuts and both wheel and tire assemblies.
6. Remove rear hub assemblies as described in Note 42a, Steps 3 through 6.
7. If car is equipped with Track Master system, disconnect wiring connectors from sensors and wiring harness from rear brake pipe over axle and position harness out of way.
8. Disconnect brake lines at wheel cylinders.
9. Disconnect rubber brake hose and cap the hose to minimize fluid leakage.
10. Disconnect overtravel link from bracket on rear axle.
11. Deflate shock absorbers by disconnecting white air line at height control valve.
12. Remove four nuts that hold brake backing plates to spindles and move backing plates out of way.

CAUTION: Do not let backing plate hang unsupported. Parking brake cable could be damaged.

13. Remove wheel spindles following procedure outlined in Note 44a, Steps 6 through 10.
14. Remove screw securing rear brake pipe distributor to axle.
15. Remove brake pipes from four clips securing pipes to axle housing.
16. Disconnect shock absorbers at lower mounts and position out of way.
17. Raise axle to relieve tension on upper control arms and remove bolt and nut securing each upper control arm to axle brackets.

WARNING: STAND CLEAR OF AXLE ASSEMBLY WHEN PERFORMING NEXT STEP. SPRINGS COULD SNAP FROM THEIR SEATS RESULTING IN POSSIBLE INJURY OR DAMAGE.

18. Carefully lower axle until spring tension is relieved, then remove springs by hand.
19. Remove bolt and nut securing each lower control arm to its axle bracket.

(NOTE: Axle may have to be rotated slightly in order to remove bolts).

20. Remove rubber bumpers from top of axle housing.
21. Lower axle and remove from car.

b. Installation

1. Install rubber bumpers on top of new axle.
2. Secure brake pipes to axle using four clips.
3. Position brake pipe distributor to axle and secure with screw.
4. Position new axle under car.
5. Raise axle only as far as necessary to insert lower control arms in axle brackets. Install lower arms and bolts and nuts but do not torque at this time.

(NOTE: It may be necessary to rotate axle slightly to align bolt holes. If so, use a jack stand at front or rear of one of the lower control arm brackets while adjusting axle height with hoist.)

6. Pivot upper control arms upward and secure arms temporarily in this position.
7. Fully extend shock absorbers; then raise axle until shock absorbers lower mounts are aligned. However, do not install shock absorbers at this time.
8. Install spring insulators and install springs, indexing as shown in Fig. 4-10. Raise axle just enough to compress springs slightly.
9. Drop upper control arms into axle brackets and install bolts and nuts. Do not torque at this time.
10. Position shock absorbers in lower mounts and install nuts.
11. Connect white air line to superlift port of height control valve.
12. Raise overtravel lever briefly to allow air into shock absorbers.
13. Connect overtravel lever to axle bracket. Shock absorbers will exhaust to residual pressure of 8-15 psi.
14. Lower hoist and install stabilizer bar as described in Note 12b.
15. Raise axle until weight of car is supported by front and rear suspensions. Remove jack stands.
16. Torque lower control arm bolts while holding nuts to 145 foot-pounds, upper control arm bolts at frame to 145 foot-pounds, upper control arm bolts at axle to 110 foot-pounds, and shock absorber lower mounting nuts to 50 foot-pounds.

See CAUTION on Page 4-3.

17. Uncap rubber hose and connect to brake pipe distributor.

18. If equipped with Track Master system, route harness along top of axle and secure to brake pipe.

19. Install wheel spindles as described in Note 44b, Steps 1 through 6.

20. Install rear wheel hubs as described in Note 42b, Steps 1 through 5.

21. Using service valve, inflate Automatic Level Control system to 140 psi, or maximum pressure available.

22. Bleed brakes, Section 5, Note 6.

23. If equipped with Track Master, install wiring connectors on sensors.

24. Remove jack stands and lower car.

25. Tighten wheel nuts to 130 foot-pounds.

26. Install wheel discs and wheel shields.

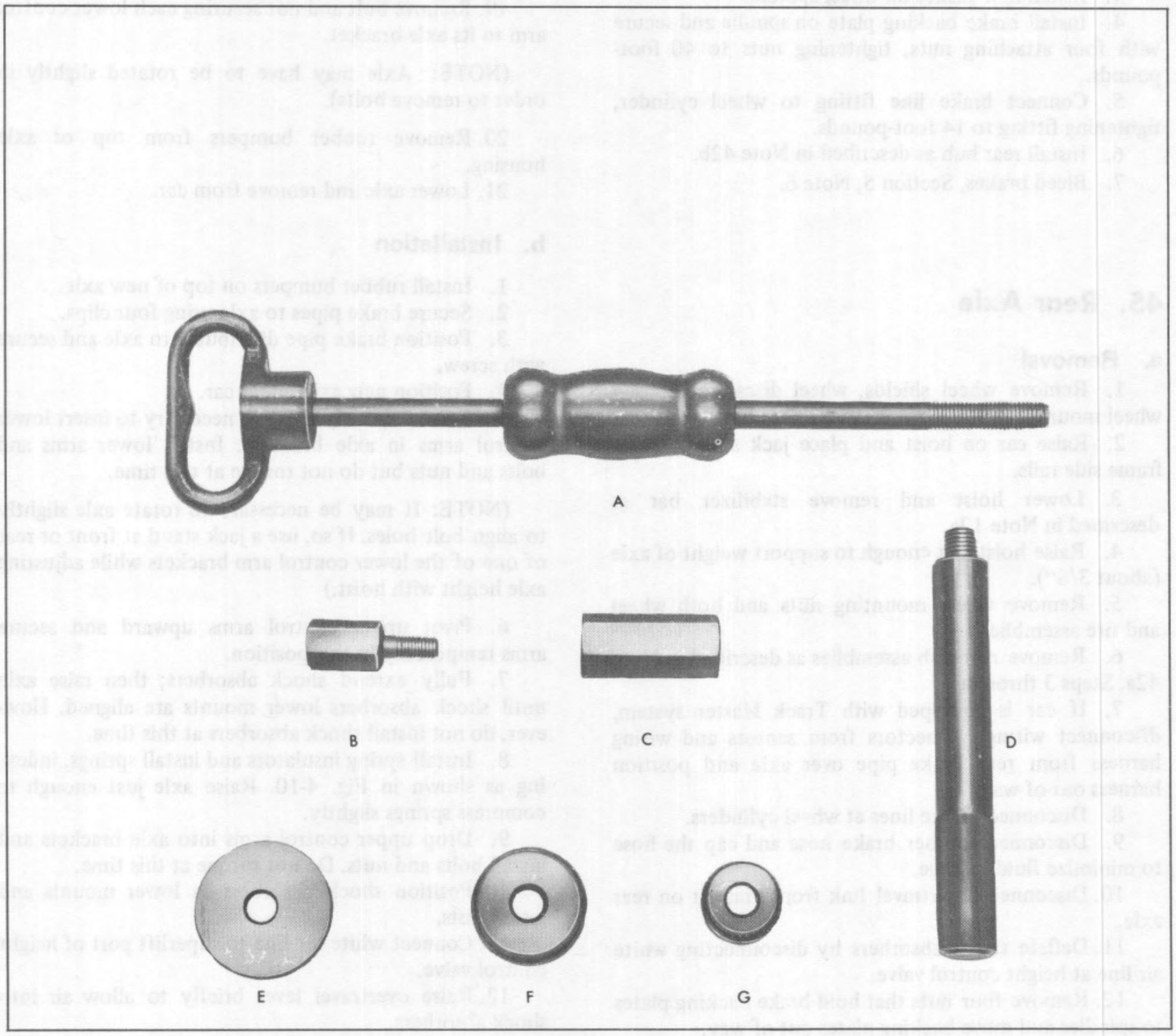


Fig. 4-51 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-2619	Slide Hammer	E	J-23114	Grease Retainer Installer
B	J-2619-4	Slide Hammer Adapter	F	J-8458	Inner Bearing Cup Installer
C	J-23692	Spindle Adapter	G	J-8849	Outer Bearing Cup Installer
D	J-8092	Universal Handle			

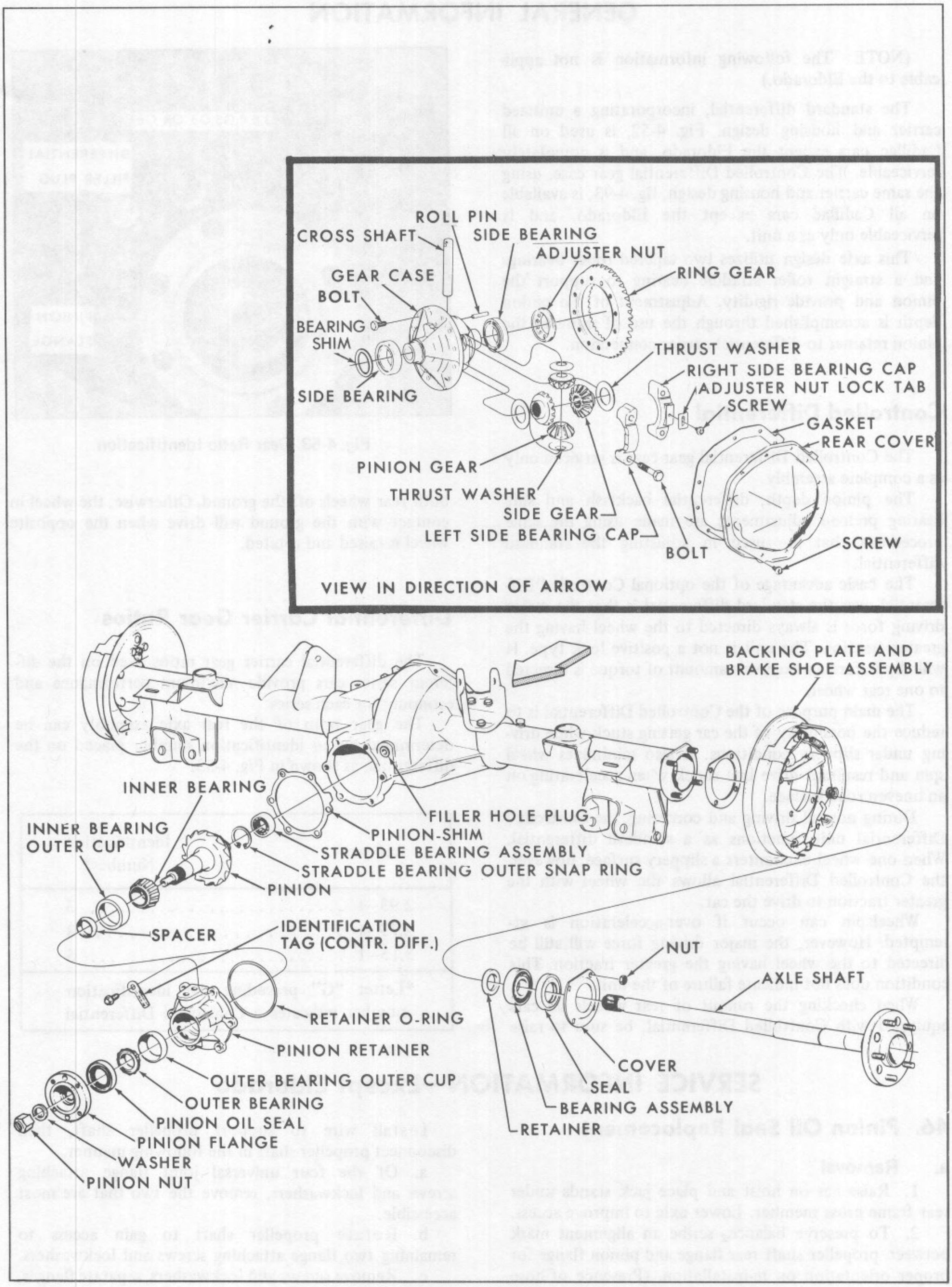


Fig. 4-52 Differential Carrier and Rear Axle

GENERAL INFORMATION

(NOTE: The following information is not applicable to the Eldorado.)

The standard differential, incorporating a unitized carrier and housing design, Fig. 4-52, is used on all Cadillac cars except the Eldorado, and is completely serviceable. The Controlled Differential gear case, using the same carrier and housing design, fig. 4-93, is available on all Cadillac cars except the Eldorado, and is serviceable only as a unit.

This axle design utilizes two tapered roller bearings and a straight roller straddle bearing to support the pinion and provide rigidity. Adjustment of the pinion depth is accomplished through the use of shims at the pinion retainer to differential carrier connection.

Controlled Differential

The Controlled Differential gear case is serviced only as a complete assembly.

The pinion depth, differential backlash and side bearing preload adjustments are made using the same procedures that are used in adjusting the standard differential.

The basic advantage of the optional Controlled Differential over the standard differential is that the major driving force is always directed to the wheel having the greater traction. The unit is not a positive lock type. It will slip before an excessive amount of torque is directed to one rear wheel.

The main purpose of the Controlled Differential is to reduce the possibility of the car getting stuck while driving under slippery conditions. It also minimizes wheel spin and resultant drive line shock when accelerating on an uneven road surface.

During normal driving and cornering, the Controlled Differential unit functions as a standard differential. When one wheel encounters a slippery surface, however, the Controlled Differential allows the wheel with the greater traction to drive the car.

Wheelspin can occur if over-acceleration is attempted. However, the major driving force will still be directed to the wheel having the greater traction. This condition does not indicate failure of the unit.

When checking the runout of rear wheels on cars equipped with Controlled Differential, be sure to raise both rear wheels off the ground. Otherwise, the wheel in contact with the ground will drive when the opposite wheel is raised and rotated.

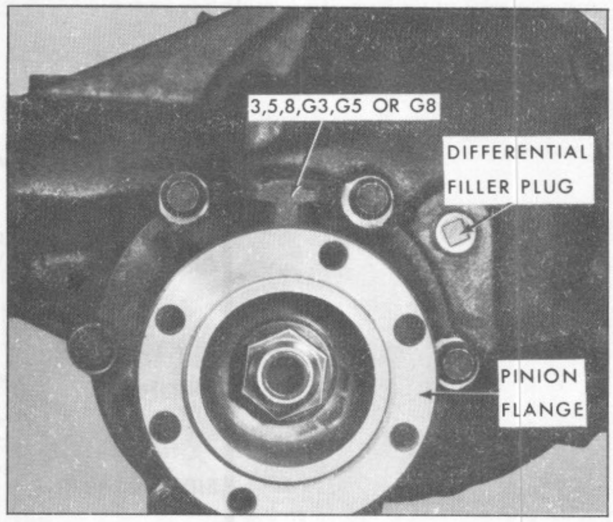


Fig. 4-53 Gear Ratio Identification

Differential Carrier Gear Ratios

The differential carrier gear ratios used on the different series cars provide maximum performance and economy for each series.

The gear ratio of the rear axle assembly can be determined by an identification number placed on the differential, as shown in Fig. 4-53.

Ratio	Identification Number*
2.93–1	3
2.73 -1	8
3.15–1	5

*Letter "G" preceding the identification number indicates a Controlled Differential

SERVICE INFORMATION—Except Eldorado

46. Pinion Oil Seal Replacement

a. Removal

1. Raise car on hoist and place jack stands under rear frame cross member. Lower axle to improve access.

2. To preserve balance, scribe an alignment mark between propeller shaft rear flange and pinion flange for proper orientation on re-installation. (Presence of hose clamps on rear of propeller shaft indicate that a field rebalancing procedure has been performed.)

Install wire to support propeller shaft, then disconnect propeller shaft in the following manner.

a. Of the four universal joint flange attaching screws and lockwashers, remove the two that are most accessible.

b. Rotate propeller shaft to gain access to remaining two flange attaching screws and lockwashers.

c. Remove screws and lockwashers, separate flanges, and allow shaft to rest on wire.

3. Place a drain pan under differential.

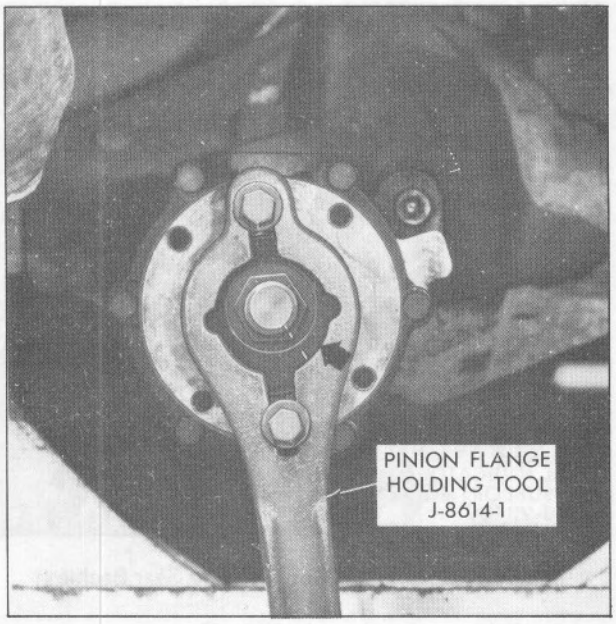


Fig. 4-54 Pinion Flange, Nut and Shaft Marking

4. Install pinion flange holding Tool J-8614-1 with spacers J-21044-5 to pinion flange using 3/8" bolts.

5. Mark the position of the pinion flange, pinion shaft and nut so the proper pinion bearing pre-load can be maintained. Fig. 4-54.

6. Attach torque Multiplier, J-23410, to a 1-1/4" socket. Attach Torque Multiplier, J-23410, to Pinion Flange Holding Tool, J-8614-1, with Torque Multiplier Link, J-23413, Fig. 4-55.

7. Install breaker bar on torque multiplier and remove pinion nut and washer.

8. Install Pinion Flange Puller, J-8614-2, on pinion flange. This is done by screwing the puller on its bolt until it reaches the pointed end, then inserting pointed end into end of pinion shaft. Give puller a 1/8" turn. Holding puller stationary, turn bolt until wings of puller fit snugly into recesses of flange holding tool.

9. Tighten bolt until flange can be removed from pinion assembly.

10. Remove puller tools from flange.

11. Remove oil seal by driving it out of retainer with a blunt chisel, Fig. 4-56. Do not damage retainer.

b. Inspection

1. Examine seal surface of flange for tool marks, nicks, or damage, such as a groove worn by the seal. If damaged, replace flange.

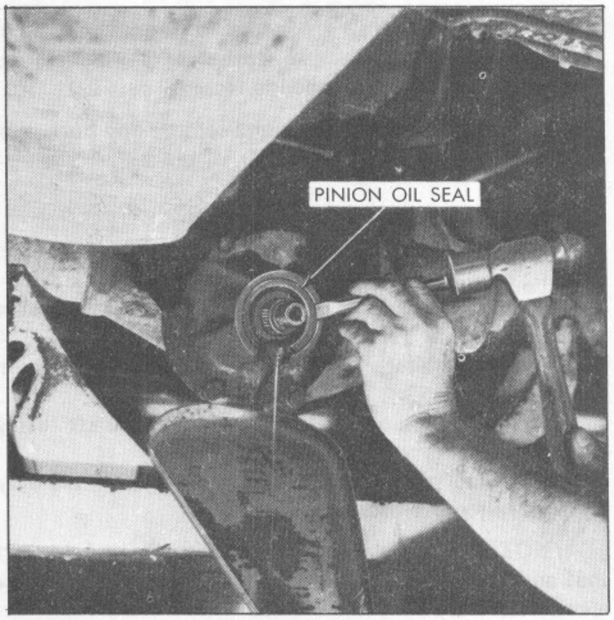


Fig. 4-56 Removing Pinion Oil Seal

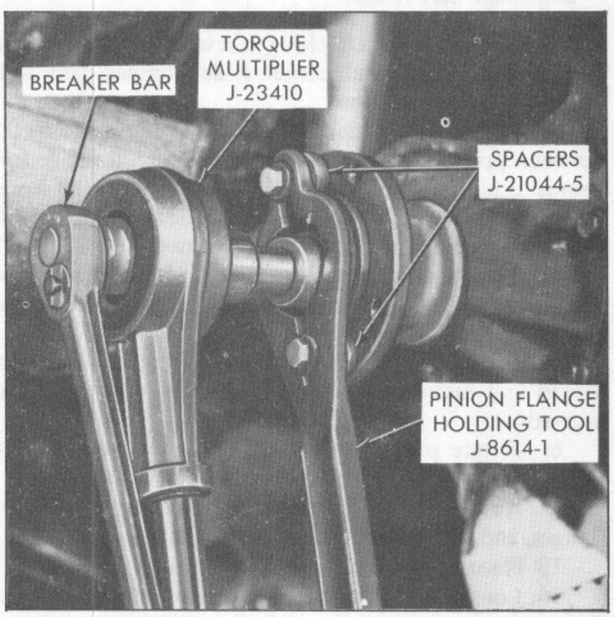


Fig. 4-55 Removing Pinion Nut

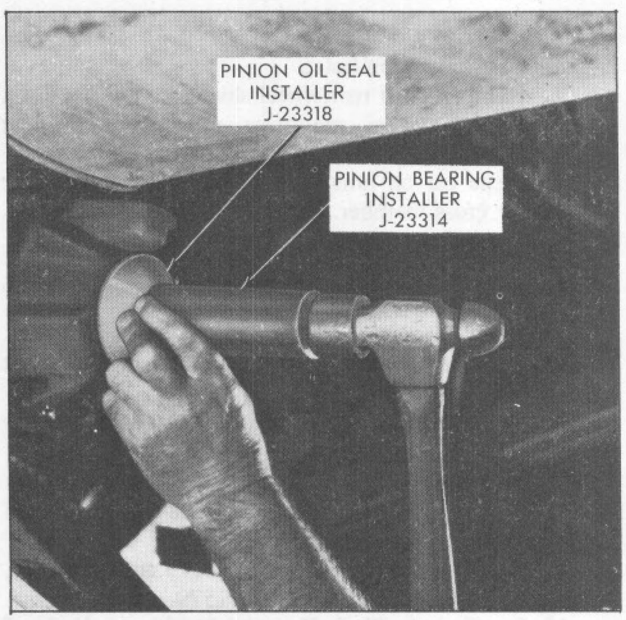


Fig. 4-57 Installing Pinion Oil Seal

(NOTE: If flange is replaced remove retainer assembly. Replace collapse spacer, "O" Ring, and manually preload as described in Note 47 part L.)

2. Examine retainer bore and remove any burrs that might cause leaks around the O.D. of the seal.

c. Installation

1. Pack inner lip of new pinion oil seal with wheel bearing lubricant.
2. Position seal on retainer. Place oil seal installer J-23318 against seal, and bearing installer J-23314 against seal installer. Tap bearing in place with ball peen hammer, Fig. 4-57.
3. Install pinion flange on pinion shaft using alignment marks made on disassembly.
4. Install pinion washer and nut. Tighten nut only enough to remove bearing end play.

(NOTE: If flange did not slip on far enough to start nut and washer, tap gently with a soft hammer until nut can be started.)

5. Install Spacers, J-21044-5, over unthreaded holes in pinion flange.
6. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with 3/8" bolts and nuts, Fig. 4-54.
7. Attach Torque Multiplier, J-23410, to 1-1/4" socket and install on pinion nut. Attach Torque Multiplier Link, J-23413, Fig. 4-55.
8. Install breaker bar on torque multiplier.
9. Tighten pinion nut 1/8" beyond alignment marks.

(NOTE: Refill with rear axle lube, Part No. 1050189, or equivalent, until fluid level is even with lower lip of filler hole.)

47. Differential Overhaul

a. Preparatory Steps

1. Position car on hoist.
2. Remove both rear wheel shields and wheel discs.
3. Loosen wheel mounting nuts on both rear wheels.
4. Raise car on hoist and place jack stands under rear frame cross member. Lower axle to improve access.

CAUTION: Never use control arms as contact points for hoist or jack stands, as damage may result.

5. Remove rear wheel mounting nuts and both rear wheels.
6. Remove push nuts securing brake drum to axle shaft bolts.
7. Remove brake drums.
8. Remove four nuts that secure retainers and backing plates to rear axle housing.
9. Attach Slide Hammer, J-2619,and Adapter, J-2619-4, to Axle Shaft Puller, J-21579.
10. Install Axle Shaft Puller, J-21579, on studs of rear axle shaft flange, Fig. 4-44.

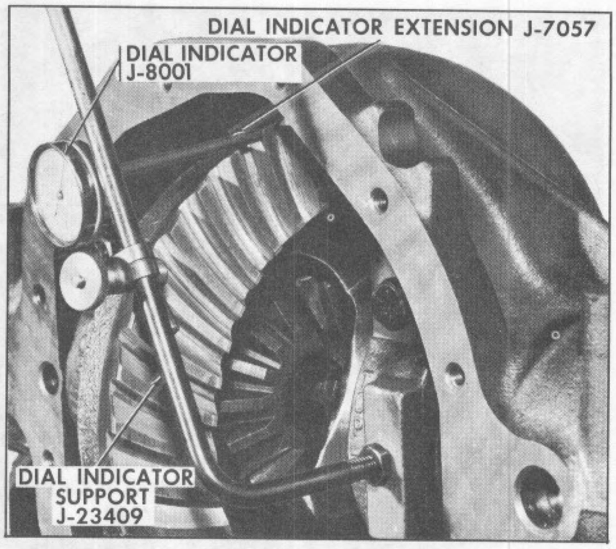


Fig. 4-58 Checking Pinion To Ring Gear Backlash

11. Drive outward with Slide Hammer to remove axle shaft. Remove both axle shafts in this manner.

(NOTE: The tapered roller unit type rear wheel bearing, when new, is bonded together to facilitate installation. If tapered roller unit bearing is used, the bearing may separate on axle shaft removal leaving the outer race in the axle housing. This is a normal condition and does not indicate failure. If the bearing is to be replaced, make sure the old bearing outer race is removed from the housing before installing a new bearing.)

12. Install two nuts on brake backing plate mounting studs to prevent backing plates from falling and damaging brake lines.

CAUTION: Brake lines must not be used to support the backing plate and brake shoe assembly as damage may result.

13. Remove two attaching screws and lockwashers that secure differential carrier nose bumper arm and remove nose bumper arm.
14. To preserve balance, scribe an alignment mark between propeller shaft rear flange and pinion flange for proper orientation on re-installation. (presence of hose clamps on rear of propeller shaft indicate that a field rebalancing procedure has been performed.)

Install wire or fan belt to support propeller shaft as shown in Fig. 4-27, then disconnect propeller shaft in the following manner.

a. Of the four universal joint flange attaching screws and lockwashers, remove the two that are most accessible.
b. Rotate propeller shaft to gain access to remaining two flange attaching screws and lockwashers.
c. Remove screws and lockwashers, separate flanges, and allow shaft to rest on wire or fan belt.

15. Place a drain pan under differential.
16. Loosen 12 differential cover to housing screws. Slide cover back on screws and allow lubricant to drain from differential.

17. Remove 12 differential cover to housing screws and remove differential cover and gasket. Discard gasket.

CAUTION: Take care not to damage brake lines and hoses now and throughout procedure.

b. Backlash Check

1. Remove adjuster nut lock tab.
2. Using Dial Indicator, J-8001, and Dial Indicator Support, J-23409, determine and record ring gear to pinion backlash, Fig. 4-58. If original pinion and ring gear set is to be used on reassembly, and mileage is greater than approximately 3000, it is important to re-establish this exact backlash measurement on reassembly.

(NOTE: Indicator button should touch the ring gear tooth on face of drive side at heel. Angle between indicator button and tooth face must be 90°. Backlash is measured by rocking ring gear back and forth with pinion securely held. Take three readings evenly spaced around the ring gear. The readings should all fall between .005" and .010" and should not vary from each other by more than .003".)

3. Remove dial indicator and support from unit.

c. Tooth Pattern Check

1. Remove all but one of six pinion retainer to differential carrier screws. Loosen the remaining screw but do not remove at this time.
2. Install Guide Pins, J-23311.
3. Attach Slide Hammer, J-2619, to Pinion Puller, J-23324.

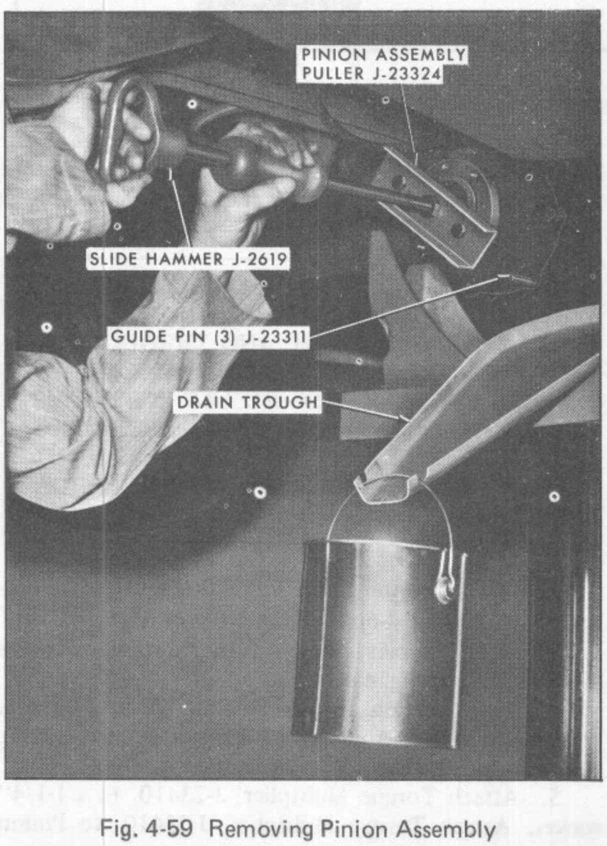


Fig. 4-59 Removing Pinion Assembly

4. Attach Pinion Puller, J-23324, to pinion flange, Fig. 4-59.
5. Using slide hammer, unseat pinion assembly from differential carrier, Fig. 4-59. Leave shim(s) in installed position.
6. Remove remaining screw, and slide pinion over guide pins and out of differential carrier.
7. Remove puller tools from pinion flange.
8. Clean ring gear teeth thoroughly with solvent and paint teeth with a light even coat of gear marking compound.

(NOTE: Wipe excess lube from pinion cavity in carrier as lube free teeth provide a better visual pattern.)

9. Clean pinion gear teeth thoroughly with solvent and re-install assembly in housing using three of six screws, tightening to 30 foot-pounds.
10. Turn ring gear manually one complete turn in each direction, using a box end wrench on the ring gear to case bolts. During this operation, hold a shop cloth around the pinion flange and grip firmly so that additional effort is required to turn ring gear, Fig. 4-60. This load assures clarity and accuracy of tooth pattern.
11. Compare pattern to samples in Tooth Pattern Chart, Fig. 4-61, to determine whether shim change is required. See effect of shim change in Fig. 4-62.

d. Bench Check of Pinion Flange Runout

1. Remove pinion assembly from housing by following procedure in Note 47d, Steps 1 through 7.
2. Remove pinion shim from carrier and remove and discard pinion retainer O-ring.
3. Install pinion retainer in Holding Fixture, J-23320, Fig. 4-63.
4. Using a wire brush, clean pinion flange face thoroughly.

(NOTE: Heavy scale may have to be cleaned with carbon scraper. Never use a file on any area of the flange. If rust cannot be removed from pinion flange face, replace flange. Inspect flange face for damage or burrs. If either of these conditions exist, flange must be replaced. Clean propeller shaft rear flange also, to facilitate re-installation.)

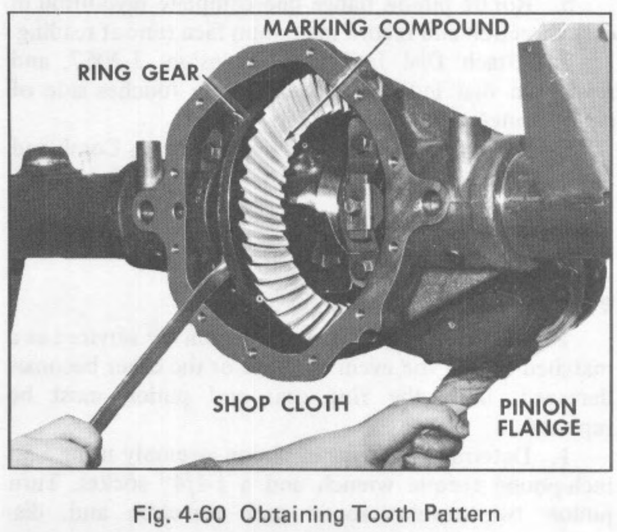


Fig. 4-60 Obtaining Tooth Pattern

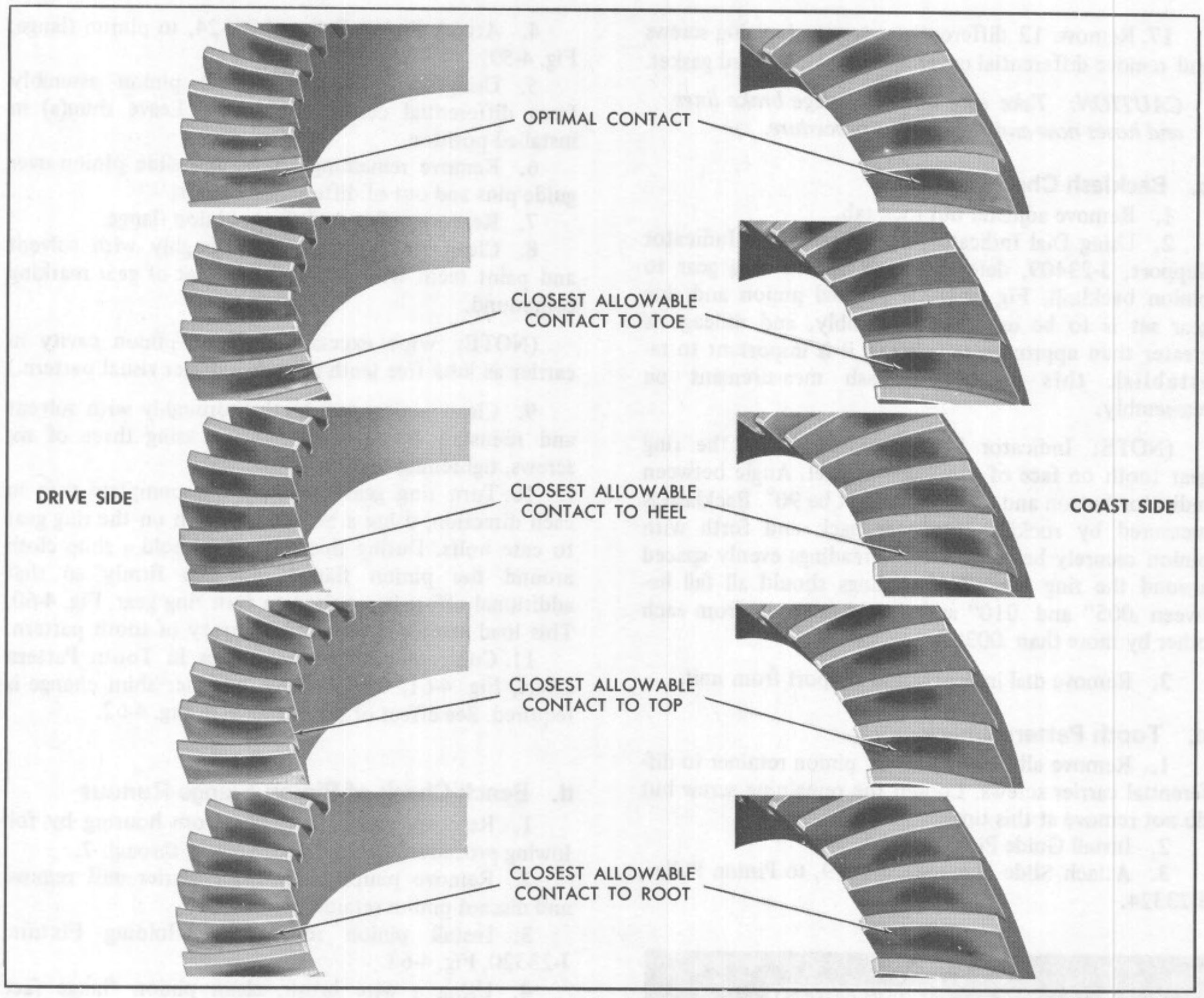


Fig. 4-61 Tooth Pattern Chart

5. Remove one pinion retainer screw from holding fixture and install Dial Indicator, J-8001, and Support, J-6126, so that indicator touches flange between bolt holes and pilot diameter at a 90° angle, Fig. 4-64. Set dial to zero.

6. Rotate pinion flange one complete revolution in each direction and record maximum face runout reading.

7. Attach Dial Indicator Extension, J-7057, and reposition dial indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-65.

8. Repeat Step 6 to find radial runout. Combined face and radial runout should not exceed .005"

e. Pinion Disassembly

The differential ring gear and pinion are serviced as a matched set. In the event that one or the other becomes damaged, both the ring gear and pinion must be replaced.

1. Determine preload of pinion assembly using a 50 inch-pound torque wrench and a 1-1/4" socket. Turn pinion two revolutions in each direction and, disregarding torque required to begin turning pinion, record maximum reading to be used at time of reassembly in Note 47 1, Step 23c.

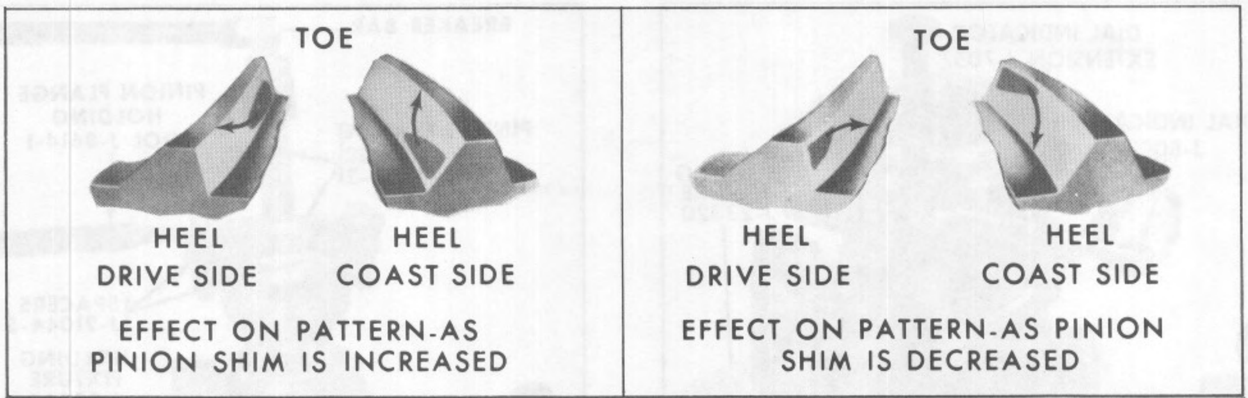
WARNING: FAILURE TO EMPLOY RETAINING BAG J-23320-1, AS DIRECTED IN THE FOLLOWING STEP AND THROUGHOUT PROCEDURE MAY CAUSE DAMAGE TO PARTS AND MAY ALSO RESULT IN SERIOUS PERSONAL INJURY. EVEN WITH BAG INSTALLED, BE CERTAIN TO KEEP FEET AWAY FROM DIRECTLY UNDER PINION ASSEMBLY.

2. Install Retaining Bag, J-23320-1, on Holding Fixture, J-23320, Fig. 4-66.

3. Install Spacers, J-21044-5, over unthreaded holes in pinion flange, Fig. 4-66.

4. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with two 3/8-inch bolts and nuts, Fig. 4-66.

5. Attach Torque Multiplier, J-23410, to a 1-1/4" socket. Attach Torque Multiplier, J-23410, to Pinion



NOTE: The above illustration is an extreme condition. However, if a new bearing retainer, housing, or ring gear and pinion are installed a similar pattern might result. The pinion shim is many thousands too thick or too thin. Always check for proper back-lash .005" to .010" after any major change in pinion shim(s).

Fig. 4-62 Shim Changes on Tooth Pattern—Maintaining Correct Backlash

Flange Holding Tool, J-8614-1, with Torque Multiplier Link, J-23413, Fig. 4-66.

6. Install breaker bar on torque multiplier and remove pinion nut and washer.

7. Scribe or punch an alignment mark to align pinion shaft splines to pinion flange splines on reassembly.

8. Install Pinion Flange Puller, J-8614-2, on pinion flange, Fig. 4-67. This is done by screwing the puller on its bolt until it reaches the pointed end, then inserting pointed end into end of pinion shaft. Give puller a 1/8 turn. Holding puller stationary, turn bolt until wings of puller fit snugly into recesses of flange holding tool.

9. Tighten bolt until flange can be removed from pinion assembly, fig. 4-67.

(NOTE: Pinion may fall into retaining bag when flange is removed.)

10. Remove puller tools from flange.

(NOTE: If pinion did not fall into retaining bag, tap pinion shaft several times with a soft hammer. If this fails, place a block of wood on shaft and, supporting pinion from under retaining bag with one hand, use a heavy ball peen hammer to separate pinion from retainer.)

11. Remove retaining bag and pinion from holding fixture being careful not to drop pinion.

12. Pry pinion oil seal from retainer, using care so as not to damage inner surface of retainer, Fig. 4-68.

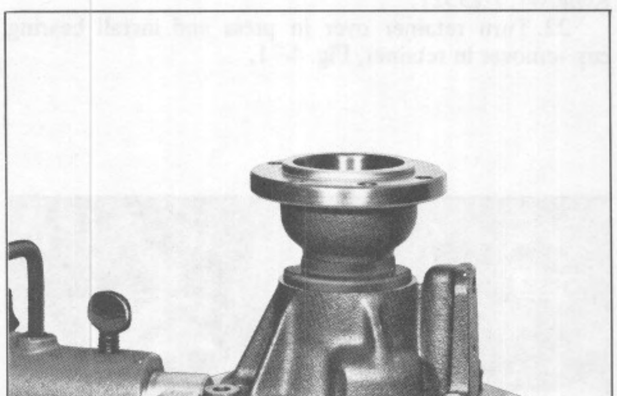


Fig. 4-63 Pinion Assembly In Holding Fixture

Fig. 4-64 Checking Pinion Flange Face Runout

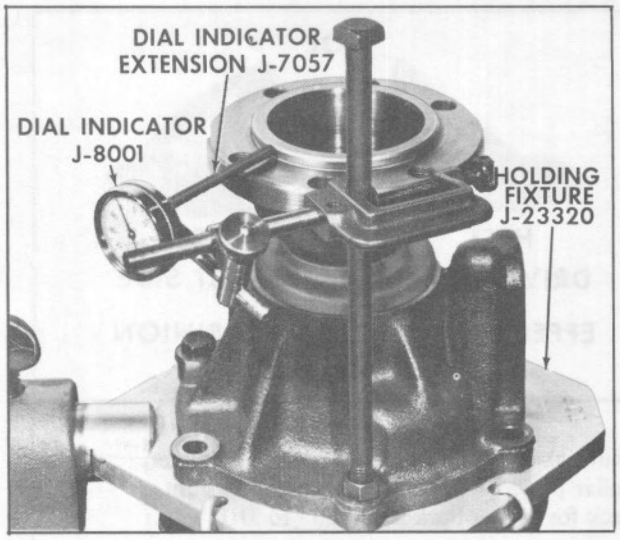


Fig. 4-65 Checking Pinion Flange Radial Runout

13. Remove outer bearing from retainer.

14. Remove collapse spacer from pinion shaft and discard spacer.

15. Install Bearing Plate, J-23399-1, on pinion and both halves of Bearing Puller, J-23399-2, Fig. 4-69.

16. Position Puller Bar, J-8433-1, on top of pinion shaft. Then, using two Bolts, J-23399-4, attach puller bar to bearing plate, Fig. 4-69.

17. Place assembly in vise, Fig. 4-69. With one hand on pinion gear teeth, tighten large center bolt on puller bar until pinion inner bearing is removed.

18. Attach Universal Handle, J-8092, to Pinion Outer Bearing Outer Cup Remover, J-23671.

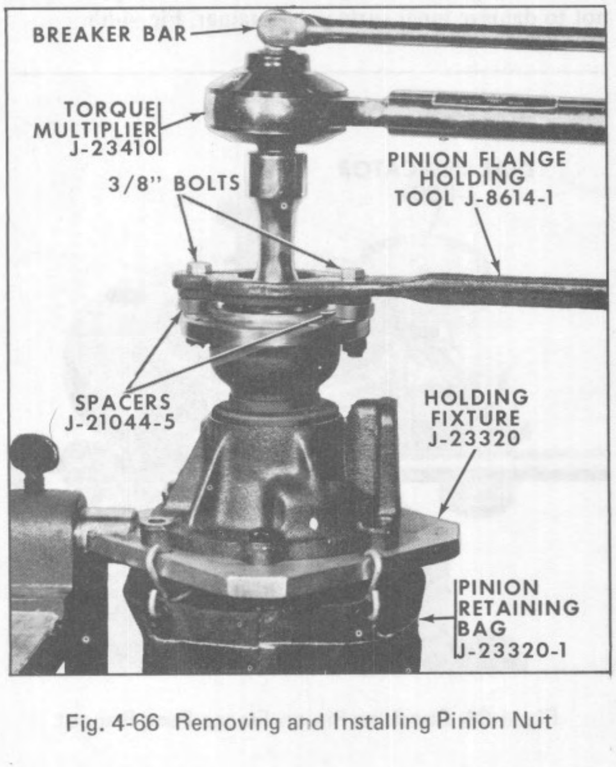


Fig. 4-66 Removing and Installing Pinion Nut

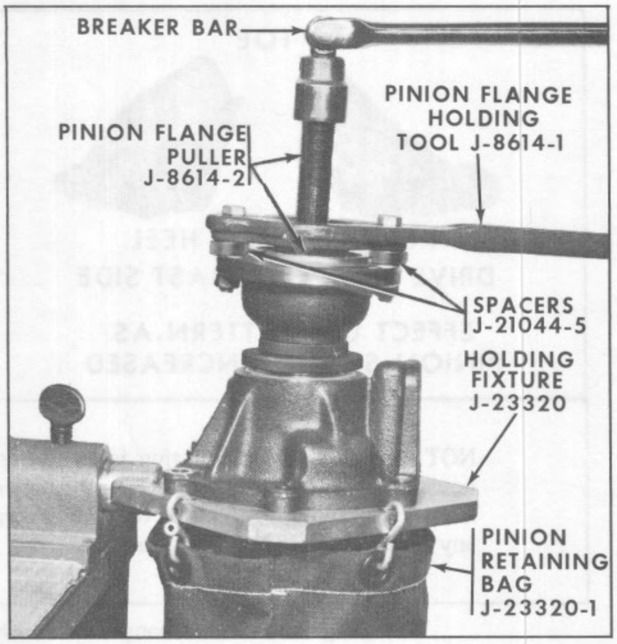


Fig. 4-67 Removing Pinion Flange

19. Install Pinion Outer Bearing Outer Cup Remover, J-23671, in retainer Fig. 4-70.

(NOTE: When installing remover, it will be necessary to slide one end of tool into oil passage in retainer. Then slide tool into position to remove outer bearing cup.)

20. Place retainer in arbor press and carefully press outer bearing cup from retainer.

21. Remove Universal Handle, J-8092, from Pinion Outer Bearing Outer Cup Remover, J-23671, and install it in raised side of Pinion Inner Bearing Outer Cup Remover, J-23321.

22. Turn retainer over in press and install bearing cup remover in retainer, Fig. 4-71.

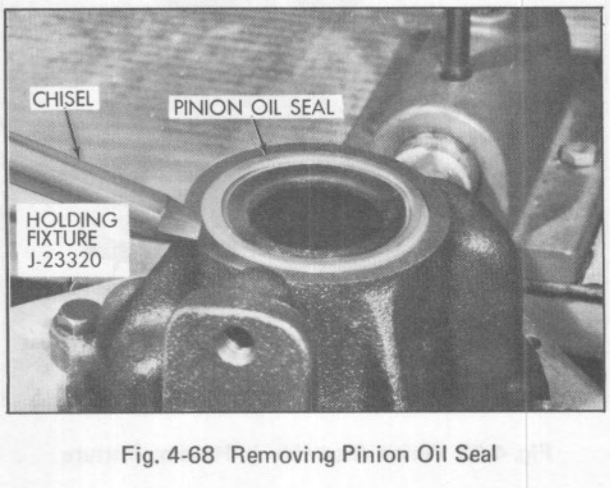


Fig. 4-68 Removing Pinion Oil Seal

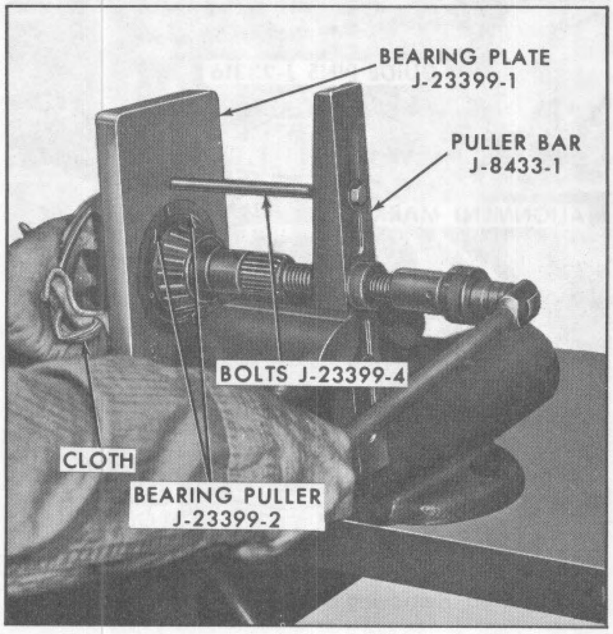


Fig. 4-69 Removing Pinion Inner Bearing

23. Carefully press inner bearing outer cup from retainer.

f. Cleaning and Inspection of Pinion Assembly Components

1. Clean all parts with cleaning solvent.
2. Inspect all parts for nicks, wear, or cracks.

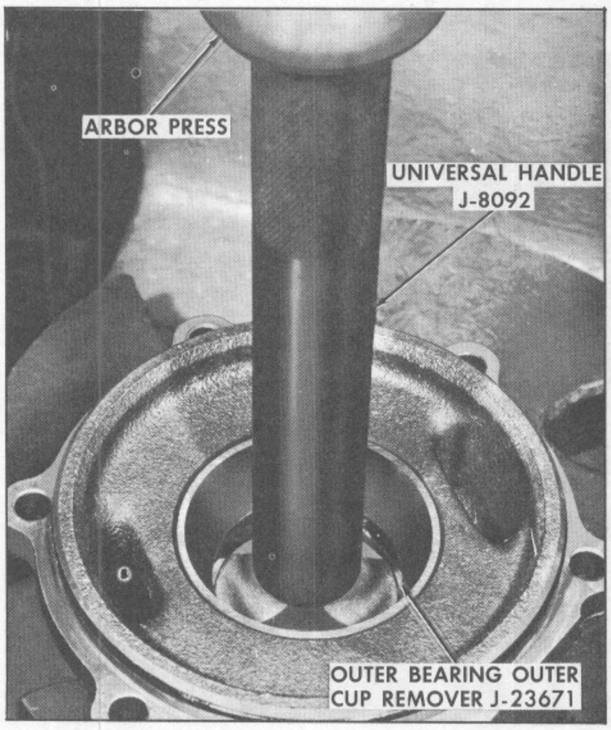


Fig. 4-70 Removing Outer Bearing Outer Cup

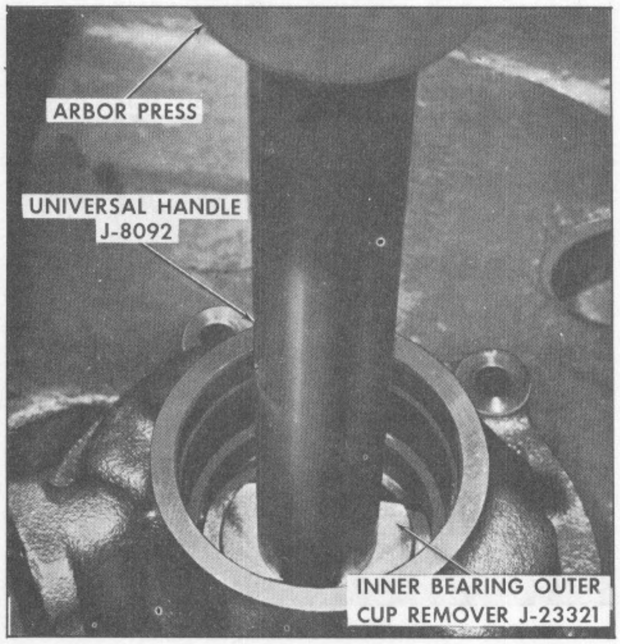


Fig. 4-71 Removing Inner Bearing Outer Cup

g. Checking Cap Spread and Removing Gear Case Assembly

1. Install Dial Indicator, J-8001, Dial Indicator Support, J-23409, and Plate, J-23409-1, as shown in Fig. 4-72. Indicator should make firm contact with plate and a 90° angle with plate. Set dial indicator to zero.

2. Loosen but do not remove mounting bolts securing left bearing cap to carrier.

(NOTE: Use extreme care to avoid disturbing dial indicator, support, or plate when loosening mounting bolts.)

3. Loosen adjuster nut, using Spanner Wrench, J-23398, until tension on adjuster nut is released.

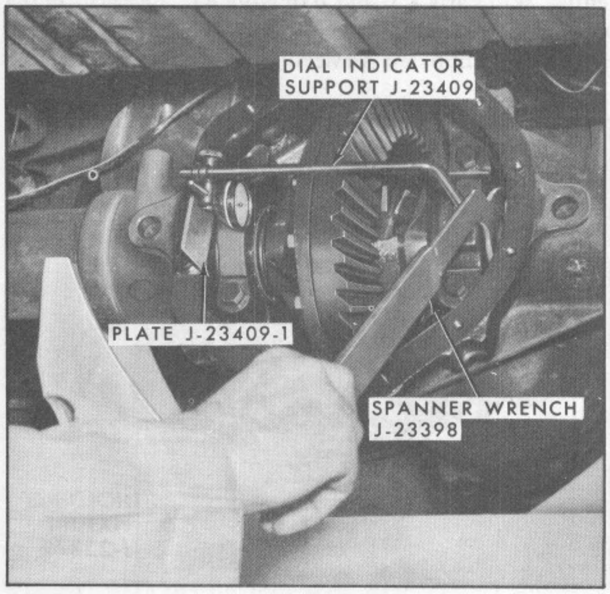


Fig. 4-72 Obtaining Cap Spread

Fig. 4-73 Removing and Installing Gear Case

4. Record reading from dial indicator and remove indicator, support, and plate from carrier.

5. Remove both bearing caps.

6. Remove adjuster nut.

7. Slide gear case to right to remove differential shim.

8. Remove differential gear case from carrier housing, Fig. 4-73.

CAUTION: Use extreme care to prevent differential side bearing outer cups from dropping when gear is removed, resulting in damage to parts.

h. Gear Case Disassembly

(NOTE: When working with Controlled Differential, skip Parts i, j, and o of Note 47, and perform the equivalent procedure of Note 49. The differential ring gear and pinion are serviced as a matched set. In the event one or the other becomes damaged, both the ring gear and pinion must be replaced.)

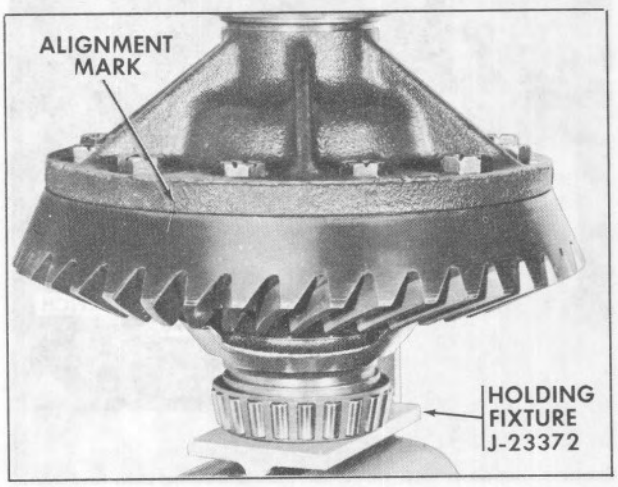


Fig. 4-74 Position of Gear Case on Holding Fixture

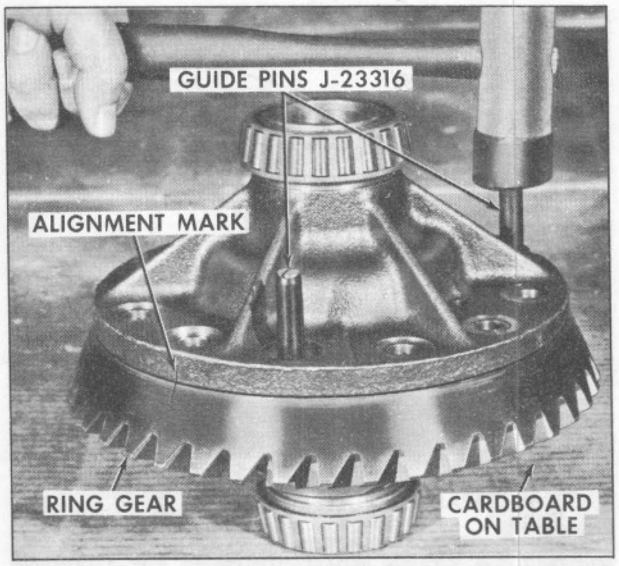


Fig. 4-75 Removing Ring Gear From Gear Case

1. Install Differential Case Holding Fixture J-23372, in vise, and position differential case on holding tool, Fig. 4-74.

2. Scribe an alignment mark on differential case and ring gear.

3. Loosen 12 ring gear to case bolts.

(NOTE: These bolts have left hand threads.)

4. Remove only three of the twelve bolts and install Guide Pins, J-23316-1.

5. Remove gear case from holding tool and place on

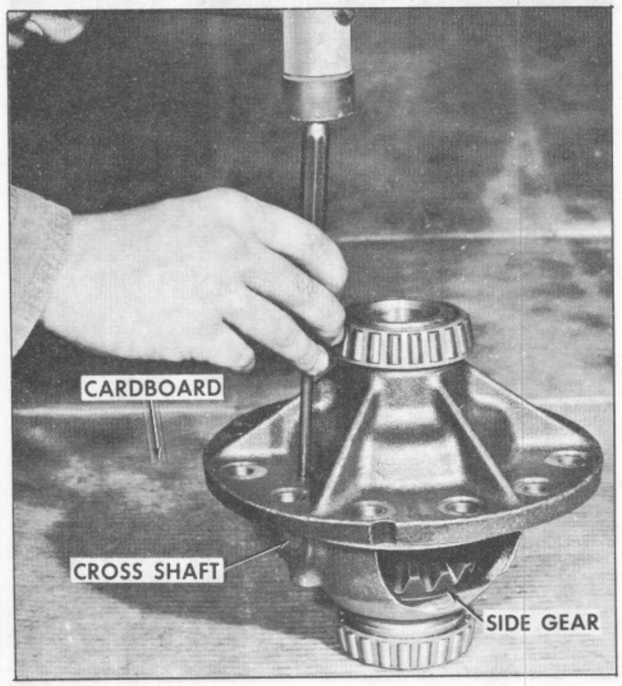


Fig. 4-76 Removing Cross Shaft Roll Pin

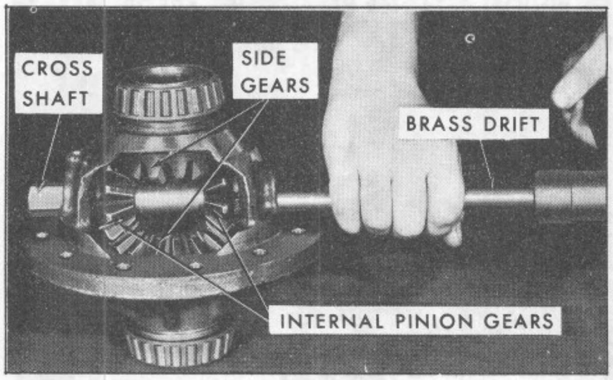


Fig. 4-77 Removing Cross Shaft

table covered with cardboard, with ring gear facing downward.

6. Remove remaining nine bolts.

7. Tap on guide pins to unseat and remove ring gear, Fig. 4-75.

8. Using a 1/4" diameter pin punch, remove differential cross shaft pin, Fig. 4-76.

9. Using a brass rod, remove differential cross shaft, Fig. 4-77.

10. Rotate pinion gear until gears align with opening in differential, Fig. 4-78.

11. Remove one differential pinion gear and thrust washer through opening in gear case.

(NOTE: When removing differential pinion gear, place one hand inside differential case and hold side gear to prevent it from falling in case.)

12. Remove remaining differential pinion gear and thrust washer.

13. Remove both side gears and thrust washers, Fig. 4-78.

14. Install Pilot, J-23406, on differential side bearing, Fig. 4-79.

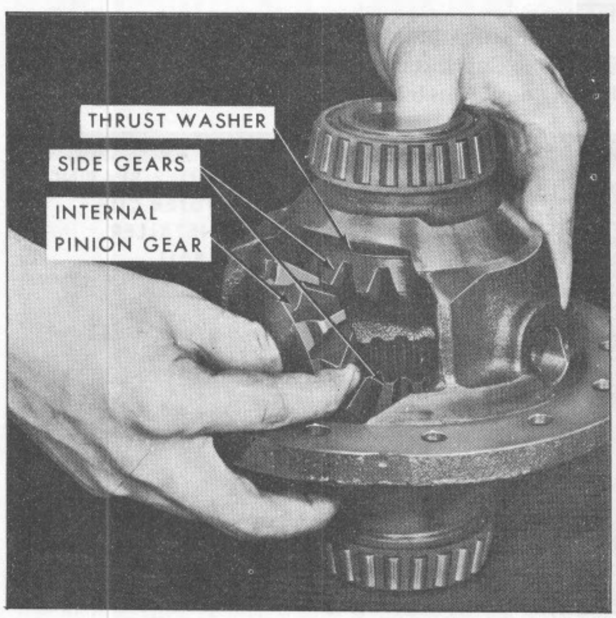


Fig. 4-78 Removing and Installing Internal Gears

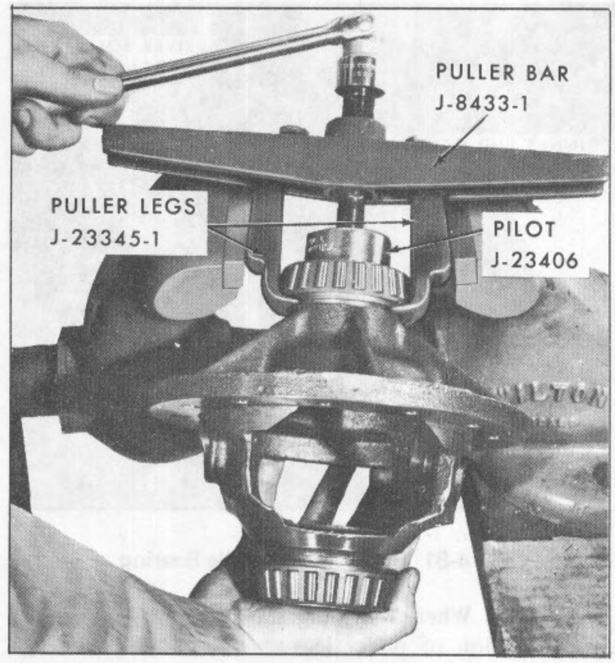


Fig. 4-79 Removing Differential Side Bearings

15. Install Puller Legs, J-23345-1, and Puller Bar, J-8433-1, on side bearing and secure assembly in vise, Fig. 4-79.

16. Tighten driver bolt and remove side bearing.

CAUTION: Side bearing and gear case will fall when bearing is removed. If possible, swing vise so that gear case is over the bench. Even a short drop may damage these parts. For this reason, place a piece of thick cardboard on bench. If these safety precautions cannot be followed, grip gear case firmly when removing side bearing.

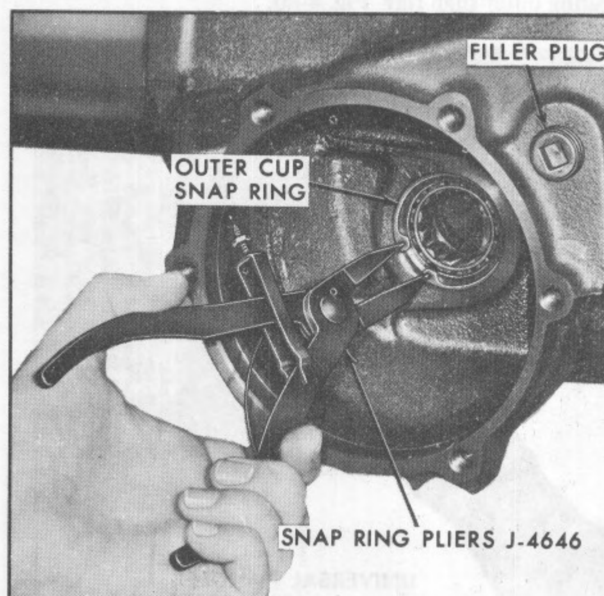


Fig. 4-80 Removing and Installing Straddle Bearing Outer Snap Ring

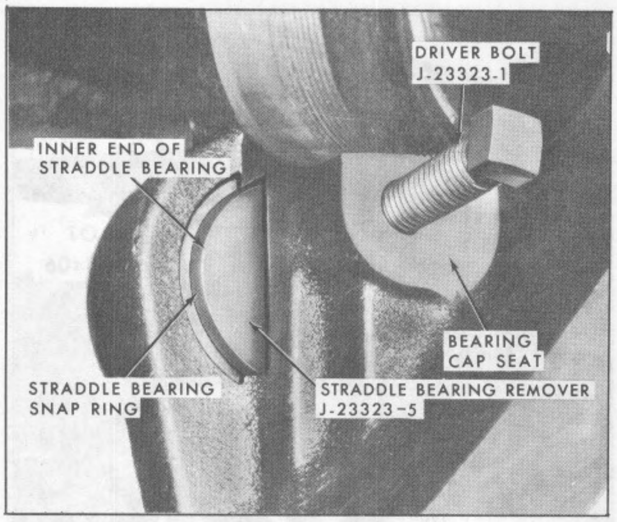


Fig. 4-81 Removing Straddle Bearing

(NOTE: When removing side bearing, be sure to check position of puller legs several times. Puller legs must remain positioned under side bearing inner race.)

17. Repeat Steps 14, 15, and 16 to remove other side bearing.

i. Cleaning and Inspection of Gear Case Assembly

1. Wash all parts in solvent or mineral spirits.
2. Using a clean cloth, wipe inside of axle housing and differential carrier clean.
3. Dry all parts thoroughly.
4. Visually inspect all parts for chips, nicks, or excessive wear.

j. Straddle Bearing Removal

1. Using Snap Ring Pliers, J-4646, remove straddle bearing outer snap ring, Fig. 4-80.

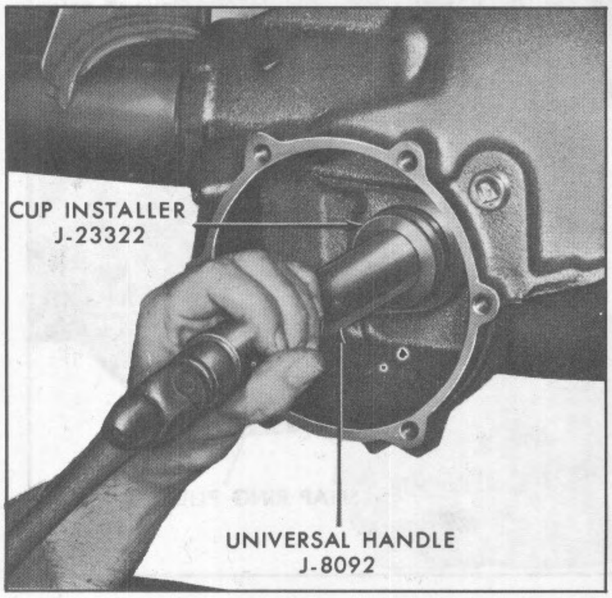


Fig. 4-82 Installing Straddle Bearing Assembly

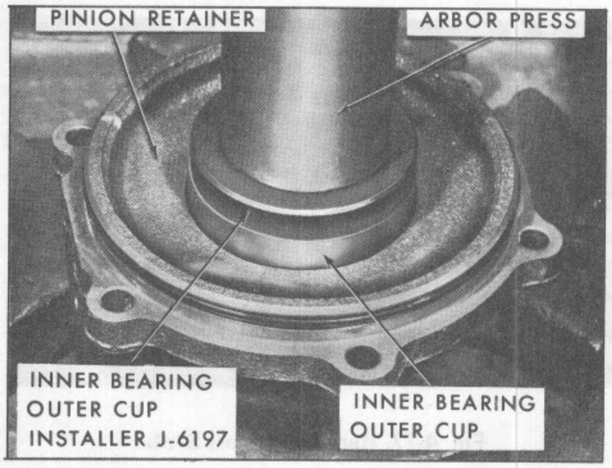


Fig. 4-83 Installing Inner Bearing Outer Cup

2. Install Straddle Bearing Remover, J-23323-5, Fig. 4-81, centering remover on bearing.
3. Install Driver Bolt, J-23323-2, in bearing cap mounting bolt hole, Fig. 4-81.
4. Tighten driver bolt and remove straddle bearing assembly.

k. Straddle Bearing Installation

1. Attach Universal Handle, J-8092, to Bearing Installer, J-23322, and install straddle bearing and outer race assembly, Fig. 4-82.
2. Using Snap Ring Pliers, J-4646, install outer snap ring to secure straddle bearing outer race in differential carrier, Fig. 4-80.

l. Pinion Assembly

1. Position inner bearing outer cup and Inner Bearing Outer Cup Installer, J-6197, on pinion retainer. Using arbor press, install inner bearing outer cup into retainer, Fig. 4-83.
2. Remove cup installer, and turn retainer over in press.
3. Position outer bearing outer cup and Outer Bearing Outer Cup Installer, J-8611, on retainer. Press outer bearing outer cup into retainer, Fig. 4-84.

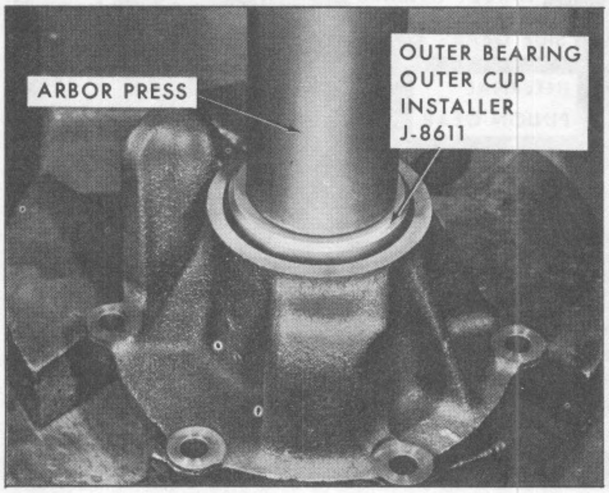


Fig. 4-84 Installing Outer Bearing Outer Cup

4. Lubricate pinion outer bearing with differential lubricant and install outer bearing in retainer.

5. Pack inner lip of new pinion oil seal with wheel bearing lubricant.

6. Position oil seal on retainer, Fig. 4-85. Place Oil Seal Installer, J-23318, against seal.

7. Carefully press oil seal into pinion retainer.

8. When properly installed, oil seal should protrude approximately 1/16".

9. Remove oil seal installer.

10. Apply a light coat of differential lubricant on pinion inner bearing.

11. Using Bearing Installer, J-23314, and arbor press, install inner bearing on pinion shaft, Fig. 4-86.

12. Remove pinion shaft from press.

13. Install a new collapse spacer on pinion shaft.

14. With pinion shaft and retainer on bench, insert pinion shaft through retainer and position pinion flange on shaft using alignment marks made on disassembly.

15. Install pinion nut washer and pinion nut and tighten with fingers.

(NOTE: If flange did not slip on far enough to start nut and washer, tap gently with a soft hammer until nut can be started.)

16. Install Spacers, J-21044-5, over unthreaded holes in pinion flange.

17. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with 3/8" bolts and nuts, Fig. 4-66.

18. Attach Torque Multiplier, J-23410, to 1-1/4" socket and install on pinion nut. Attach Torque Multiplier Link, J-23413, Fig. 4-66.

19. Install breaker bar on torque multiplier.

20. Tighten pinion nut only until all end play has been removed.

21. Remove breaker bar, torque multiplier and link, holding tool, bolts, nuts, and spacers and check flange runout as follows:

Fig. 4-85 Installing Pinion Oil Seal

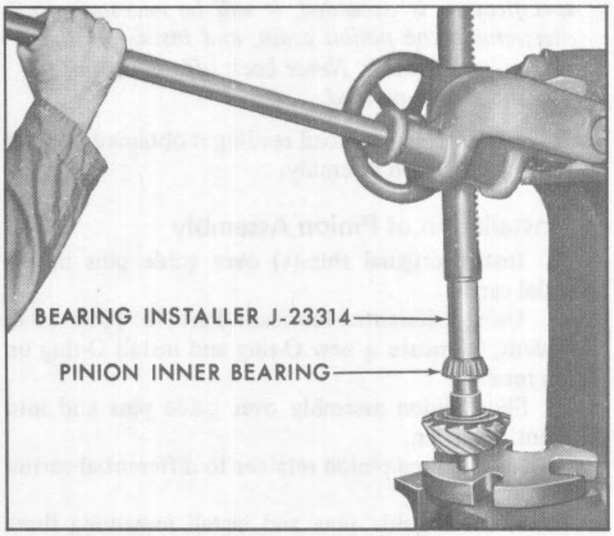


Fig. 4-86 Installing Pinion Inner Bearing

a. Remove one pinion retainer screw from holding fixture and install Dial Indicator, J-8001, and Support J-6126 so that stem touches flange between bolt holes and pilot diameter at a 90° angle, as shown in Fig. 4-64. Set dial to Zero.

b. Rotate pinion flange one complete revolution in each direction and note maximum reading obtained for face runout.

c. Install Dial Indicator Extension, J-7057, on dial indicator, and reposition indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-65.

d. Rotate pinion flange one complete turn in each direction. Note maximum radial runout. If combined face and radial runout is .005" or less, proceed to Step 23.

22. If combined runout exceeds .005" remove and re-index pinion flange 90° from its original position on pinion shaft splines. Install pinion nut and washer until end play is removed and recheck runout. If runout still exceeds specification, remove and re-index 180° and check runout. If runout is still unacceptable, replace pinion flange and check runout of new flange.

23. After end play is removed, and runout is within specification, build preload in the pinion by the following procedure:

a. Tighten pinion nut no more than 1/8 of a flat.

b. Remove torque wrench, torque multiplier and torque multiplier link.

c. Insert 50 inch-pound torque wrench and 1-1/4 inch socket on pinion nut and turn two revolutions in each direction. If new bearings are installed, preload reading should be 22-30 inch-pounds. If original bearings are used, set preload to 5 inch-pounds more than original reading, as obtained in Step e-1, but not more than 15 inch-pounds total.

d. If reading is under these specifications, continue tightening, but never tighten more than 1/8 of a flat without checking preload.

CAUTION: After end play has been removed, preload will build very quickly. If the preload

specification is exceeded, it will be necessary to disassemble the pinion again, and install another new collapse spacer. Never back off pinion nut to gain the proper preload.

24. After proper preload reading is obtained, remove all tools from pinion assembly.

m. Installation of Pinion Assembly

1. Install original shim(s) over guide pins in differential carrier.
2. Using differential lubricant, Part No. 1050189 or equivalent, lubricate a new O-ring and install O-ring on pinion retainer.
3. Slide pinion assembly over guide pins and into differential carrier.
4. Install three pinion retainer to differential carrier screws finger tight.
5. Remove guide pins and install remaining three screws. Tighten all six screws alternately to 30 foot-pounds.

n. Assembly of Gear Case

1. Apply a light coat of differential lubricant, Part No. 1050189, or equivalent, to all differential gears.
2. Install one side gear and thrust washer in gear case, Fig. 4-78.
3. Install remaining side gear and thrust washer, Fig. 4-78.

(NOTE: Hold gear and thrust washer in installed position.)

4. Install one pinion gear and thrust washer in each gear case opening, Fig. 4-78.
5. Rotate differential pinion gears and thrust washers so that cross shaft holes align with cross shaft opening in gear case, Fig. 4-77.
6. Slide Side Gear Aligning Pin, J-23310, through differential gears and thrust washers to align gears and washers, Fig. 4-87.
7. Install differential cross shaft and align hole in cross shaft with roll pin hole in differential gear case, Fig. 4-88.

Fig. 4-87 Aligning Internal Gears and Thrust Washers

Fig. 4-88 Installing Cross Shaft

8. Install roll pin on counterbore side of roll pin opening with a 1/4" diameter punch until top of roll pin aligns with bottom of counterbore.
9. Install Guide Pins, J-23316-1, in ring gear.
10. Using alignment marks made on disassembly, align ring gear with gear case and position ring gear on case.
11. Install nine ring gear to differential gear case bolts finger tight.

(NOTE: These bolts have left hand threads.)

12. Using a soft mallet, tap ring gear down onto gear case.
13. Remove guide pins and install remaining three bolts.
14. Install differential gear case on Holding Fixture J-23372, Fig. 4-74.
15. Alternate tightening ring gear bolts to 85 foot-pounds.
16. Position one side bearing and Side Bearing Installer, J-23317, on gear case, Fig. 4-89.

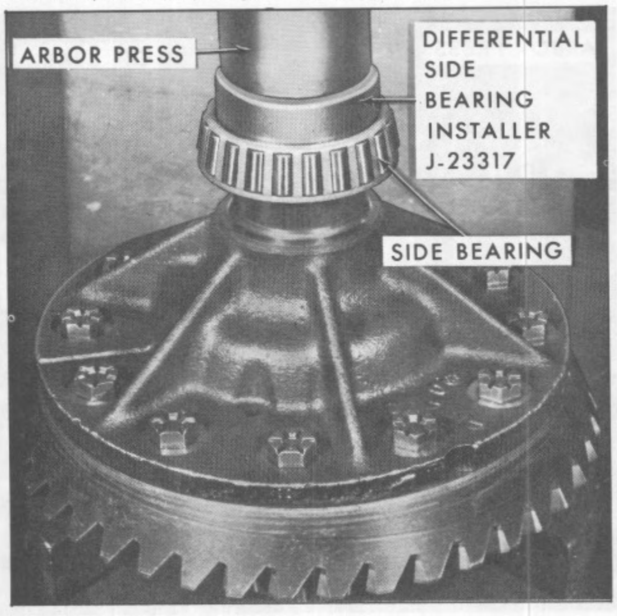


Fig. 4-89 Installing Side Bearings

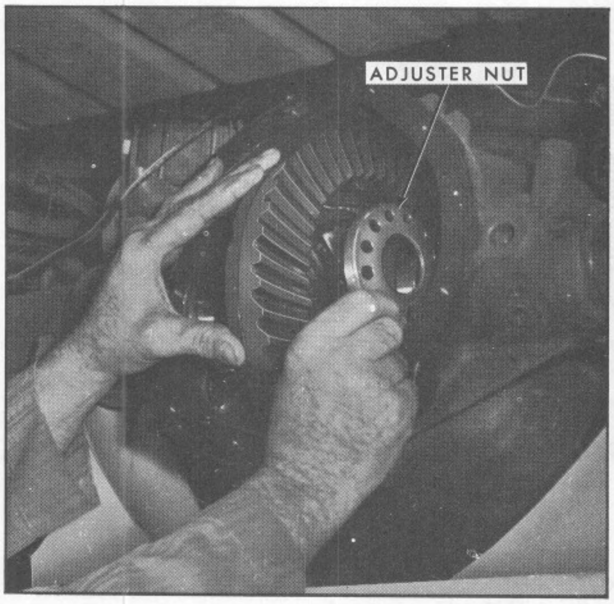


Fig. 4-90 Installing Adjuster Nut

17. Use arbor press to install side bearing.

18. Repeat Steps 16 and 17 to install remaining side bearing.

o. Gear Case Installation

1. Install bearing cups on differential side bearings. Cups will have to be held in place when installing gear case into carrier, Fig. 4-73.

(NOTE: Make sure wider bearing cup is installed in differential left side bearing, which is the shim side of the unit.)

2. Install gear case assembly into differential carrier.

3. Install differential case adjuster nut, Fig. 4-90.

CAUTION: Make sure adjuster nut threads are properly aligned with threads in differential carrier, as damage may result.

4. Install right side bearing cap and install two cap mounting bolts. Do not tighten bolts at this time.

5. Align bearing cap threads with adjuster nut threads by pulling cap straight back on mounting bolts and then gently pushing cap forward and into position.

(NOTE: Bearing cap and adjuster nut threads are properly aligned when bearing cap and carrier shoulder are flush. Adjuster nut should turn freely.)

6. Tighten bolts finger tight to keep cap seated.

7. Slide differential gear case to extreme right so that ring gear and pinion gear teeth are fully engaged. Adjuster nut should not be contacting the right hand bearing cup.

8. Slide left side bearing and cup to right and insert largest side bearing shim, which will freely slide into place. (Start with original shim). Place beveled side of shim to left, Fig. 4-91.

9. Install left bearing cap and lightly tighten mounting bolts.

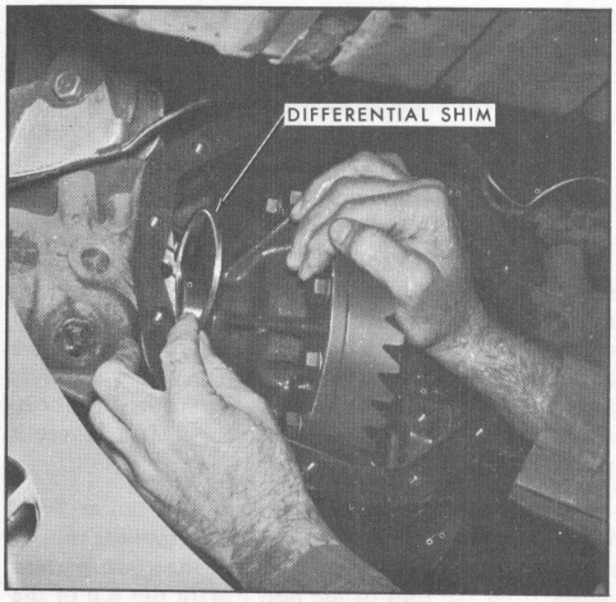


Fig. 4-91 Installing Side Bearing Shim

10. Tighten right bearing cap bolts to 50 ft. lbs.

11. Obtain proper bearing preload by the following procedure:

a. Install Dial Indicator, J-8001, and Tools J-23409-1 and J-23409-2 on differential carrier, Fig. 4-72.

b. Position button on indicator so that it rests against inside face of Plate, J-23409-2, then set dial to zero.

c. Using Spanner Wrench, J-23398, tighten adjuster nut until reading of .003" to .004" is obtained. Rotate ring gear at least one complete revolution. If cap spread reading has fallen, resume tightening adjuster nut until reading of .003" to .004" is obtained. Rotate and tighten as necessary until continuous reading within these specifications is attained.

d. Tighten left bearing cap mounting bolts to 50 ft. lbs.

(NOTE: Do not hit or bump dial indicator during this step. If indicator is disturbed in any way, adjuster nut must be backed off and procedure must be repeated.)

12. Reposition dial indicator and check ring gear to pinion backlash, Note 47c, Step 2, and Fig. 4-58.

(NOTE: Original backlash reading must be duplicated on any ring and pinion gear set that has been in use more than approximately 3000 miles. Backlash of from .006" to .008" should be obtained on lower mileage gear sets. If reading is too high, increase shim size. If reading is too low, decrease shim size. A .002" shim change will generally change backlash by .001". Recheck backlash after each shim change. If variation between three backlash readings evenly spaced around the ring gear exceeds .003", correct this condition by following procedure in Note 48 before proceeding to Step. 13.)

13. Ring gear and. pinion teeth must be clean and

free of oil to obtain correct tooth contact pattern. Paint all ring gear teeth with a light even coat of gear marking compound. Obtain tooth pattern by rotating ring gear at least one revolution in each direction, using a box end wrench on the ring gear bolts. Put a load on the pinion assembly during this operation by wrapping a shop cloth around pinion flange and holding cloth tightly. Compare pattern with samples, Fig. 4-61.

(NOTE: The Tooth Pattern Chart is designed to show the perfect tooth contact pattern and the minimum allowable distances between the pattern obtained and the four edges of each tooth. Patterns of both drive and coast sides of gear teeth must fall within the areas indicated. If either drive or coast pattern falls closer to an edge than any of the samples, pinion shim change is required.)

An increase in the thickness of the pinion shim, Fig. 4-62, moves the drive side pattern from the root of the toe toward the top of the heel; the coast pattern moves from the root of the heel toward the top of the toe. A decrease in the thickness of the pinion shim moves the drive side pattern from the top of the heel toward the root of the toe; the coast pattern moves from the top of the toe toward the root of the heel.

(NOTE: Pinion shim changes also change the amount of backlash. The above directional moves are dependent on maintaining .006" to .008" backlash.)

Although 21 different size shims are used in production, only three sizes are provided for service use: .010", .007", and .006". Used in various combinations, these three sizes are sufficient to provide any required thickness for correct tooth contact pattern. Consult the shim chart on Page 4-64 for a list of combinations.

If it is necessary to change pinion shim, the backlash should be rechecked as in Note 47c, Step 2. The final tooth contact pattern should be checked after backlash, pinion preload, and case spread have been set.

14. Install lock tab on adjuster nut. Tighten to 18 foot-pounds.

15. Using a new differential carrier cover gasket, position brake line clamp, gasket, and differential cover on carrier and install 12 screws. Tighten screws to 30 foot-pounds.

p. Completion of Rear Axle Assembly

1. Install axle shafts as described in Note 38d.
2. Install differential carrier nose bumper arm with two screws and lockwashers. Tighten to 50 foot-pounds.
3. Install propeller shaft and remove propeller shaft support wire or belt.
4. Refill rear axle to correct level with rear axle lubricant, Part No. 1050189, or equivalent.

(NOTE: Fluid level is correct when even with lower lip of the filler hole.)

5. Install differential filler plug, tightening to 30 foot-pounds.
6. Install brake drums and bleed brakes.
7. Install both rear wheels. Snug wheel mounting nuts.
8. Lower car.

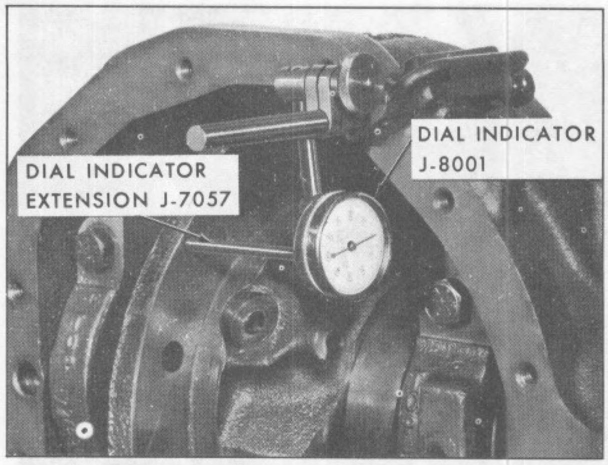


Fig. 4-92 Checking Gear Case Runout

9. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on page 3.

10. Install wheel discs and wheel shields.

48. Correction of Excessive Backlash Variance

1. Remove gear case assembly from carrier housing.
2. Remove ring gear from gear case. Check for any dirt or foreign particle that may have been trapped between ring gear and case. This is the most likely cause of backlash variance. Surface between ring gear and case must be absolutely clean.
3. Replace gear case in housing without ring gear. Use dial indicator to check runout of gear case, Fig. 4-92. If runout exceeds .003", replace gear case.
4. If gear case runout is less than .003" replace ring gear and pinion gear.

(NOTE: If backlash variance is only slightly above specification, .0035" for example, and gear case runout accounts for only part of the total, for instance .002", re-index ring gear 180° from its original position on gear case and test backlash variance. If this is still greater than .003", re-index ring gear another 90° and test again for backlash variance.)

49. Controlled Differential (Fig. 4-93)

The Controlled Differential assembly is serviced only as a unit. Disassembly of the Controlled Differential is intended only for cleaning and inspection of the gear case and its components in the event of a bearing or gear set failure. If any of the parts show signs of excessive scoring, pitting, or wear, the entire unit must be replaced.

(NOTE: When disassembling the Controlled Differential gear case, lay the parts out in the order in which they are removed from the gear case. This is necessary, as the parts are installed as matched sets at time of original assembly.)

a. Disassembly

1. Secure one axle shaft in a vise with splined end

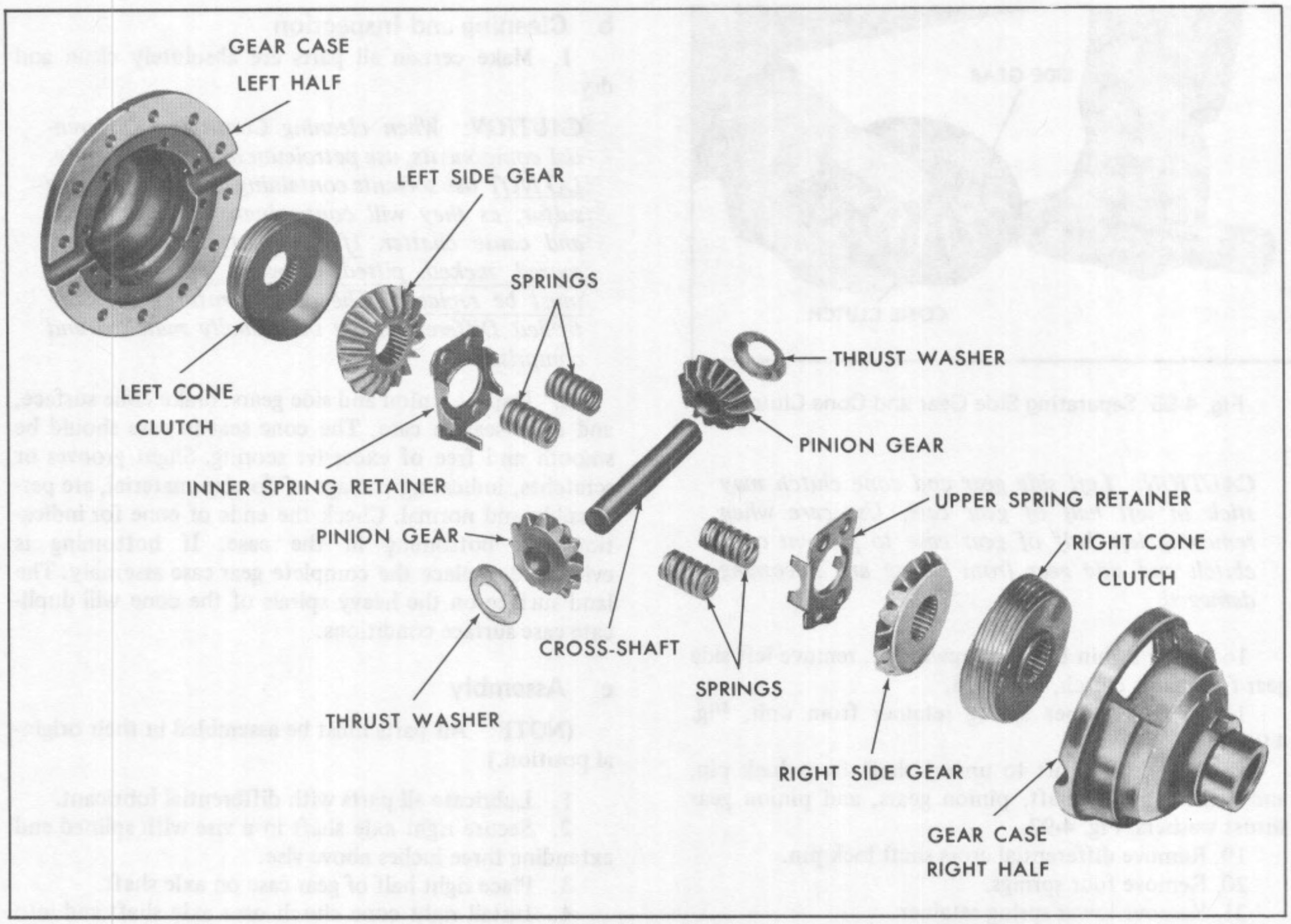


Fig. 4-93 Controlled Differential – Disassembled

of shaft extending three inches above top of vise.

2. Insert gear case on axle shaft.

3. Install Pilot, J-23406, in differential case side bearing, Fig. 4-94.

4. Using Bearing Puller, J-22888-1, remove differential case side bearing, Fig. 4-94.

5. Turn gear case over and fit it into axle shaft splines and repeat Steps 3 and 4 to remove other side bearing.

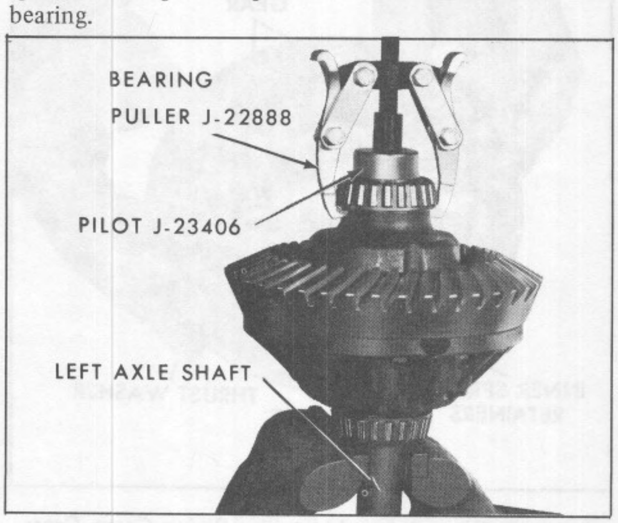


Fig. 4-94 Removing Side Bearings (Controlled)

6. Scribe an alignment mark on differential gear case and ring gear.

7. Loosen 12 ring gear to case bolts.

(NOTE: These bolts have left hand threads.)

8. Remove only three of the 12 bolts and install Guide Pins, J-23316-1.

9. Remove gear case from axle shaft and place on table covered with cardboard, with ring gear facing downward.

10. Remove remaining nine bolts.

11. Tap on guide pins to unseat and remove ring gear.

12. Insert gear case on axle shaft with right half of gear case on splines of axle shaft.

WARNING: THE CONTROLLED DIFFERENTIAL GEAR CASE IS SPRING LOADED. DO NOT REMOVE SCREWS UNTIL CASE HALVES SEPARATE, AS INJURY OR DAMAGE MAY RESULT.

13. Alternately loosen eight screws securing differential gear case halves until case halves separate.

14. After case halves separate, remove all eight screws.

15. Remove left case half.

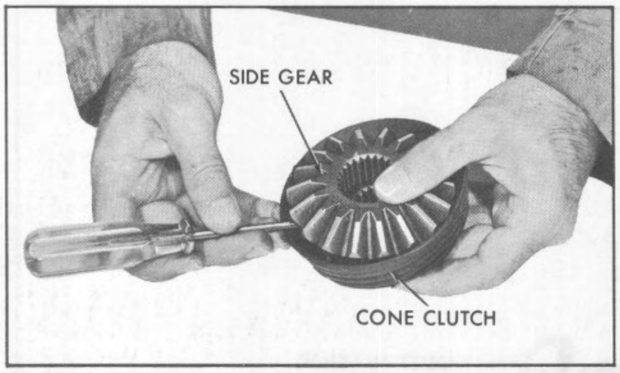


Fig. 4-95 Separating Side Gear and Cone Clutch

CAUTION: Left side gear and cone clutch may stick in left half of gear case. Use care when removing left half of gear case to prevent cone clutch and side gear from falling and becoming damaged.

16. Using a thin bladed screwdriver, remove left side gear from cone clutch, Fig. 4-95.
17. Remove upper spring retainer from unit, Fig. 4-96.
18. Lift cross shaft to unseat shaft from lock pin, and remove cross shaft, pinion gears, and pinion gear thrust washers, Fig. 4-97.
19. Remove differential cross shaft lock pin.
20. Remove four springs.
21. Remove lower spring retainer.
22. Remove remaining cone clutch and side gear from right gear case half.
23. Using a thin bladed screwdriver, remove side gear from cone clutch, Fig. 4-95.

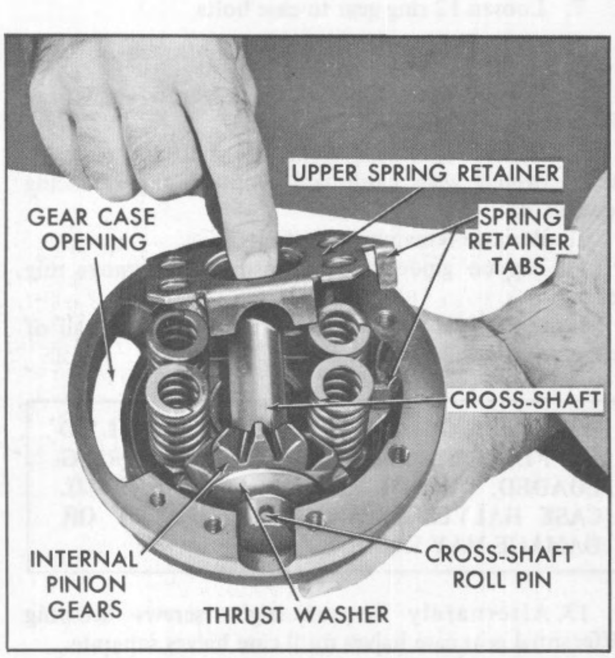


Fig. 4-96 Removing and Installing Upper Spring Retainer

b. Cleaning and Inspection

1. Make certain all parts are absolutely clean and dry.

CAUTION: When cleaning Controlled Differential components, use petroleum base solvents only. DO NOT use solvents containing chlorine or active sulfur, as they will contaminate clutch surfaces and cause chatter. If any parts are excessively scored, nicked, pitted, or worn, the entire unit must be replaced. The components of the Controlled Differential are individually matched and comprise a set.

2. Inspect pinion and side gears, brake cone surface, and cone seat in case. The cone seat in case should be smooth and free of excessive scoring. Slight grooves or scratches, indicating passage of foreign material, are permissible and normal. Check the ends of cone for indications of bottoming in the case. If bottoming is evidenced, replace the complete gear case assembly. The land surface on the heavy spirals of the cone will duplicate case surface conditions.

c. Assembly

(NOTE: All parts must be assembled in their original position.)

1. Lubricate all parts with differential lubricant.
2. Secure right axle shaft in a vise with splined end extending three inches above vise.
3. Place right half of gear case on axle shaft.
4. Install right cone clutch over axle shaft and into right half of gear case.
5. Install right side gear over axle shaft and into right cone clutch.
6. Install inner spring retainer and springs in right half of gear case with the tab on retainer opposite opening in gear case, Fig. 4-96.

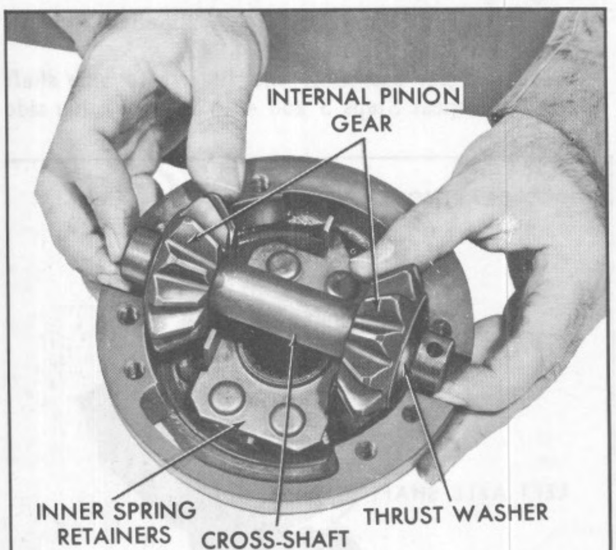


Fig. 4-97 Removing and Installing Pinion Gears, Cross Shaft and Thrust Washers

(NOTE: After spring retainer and springs are installed, check to make sure springs are properly seated on spring retainer seats.)

7. Install pinion gears and thrust washers on cross shaft.
8. Install cross shaft lock pin in hole in right half of gear case.
9. Install cross shaft, pinion gears, and thrust washers, in right half of gear case, Fig. 4-97.

(NOTE: Make sure cross shaft is properly seated on lock pin.)

10. Install upper spring retainer with tab on retainer opposite opening in gear case and aligned with tab on other retainer, Fig. 4-96.

(NOTE: After retainer is installed, check to make sure that spring seats on retainer are centered in the springs.)

11. Position left side gear on upper spring retainer.
12. Install left cone clutch on left side gear, making sure splines in cone clutch align with splines in left side gear.
13. Position left half of gear case on right half.
14. Install eight gear case screws finger tight.
15. Install left axle shaft in gear case to align splines in left cone clutch with splines in left side gear.
16. Leaving left axle shaft in place, alternate tightening gear case screws to 30 foot-pounds, Fig. 4-98.
17. Remove left axle shaft from gear case.

(NOTE: It may be necessary to tap on axle shaft with a soft mallet to permit removal of shaft from gear case.)

18. Remove gear case from axle shaft secured in vise.
19 Install Guide Pins, J-23316-1, in ring gear.
20. Using alignment marks made on disassembly, align ring gear case and position ring gear on case.
21. Install nine ring gear to differential gear case bolts finger tight.

(NOTE: These bolts have left hand threads.)

22. Using a soft mallet, tap ring gear down onto gear case.
23. Remove guide pins and install remaining three bolts.

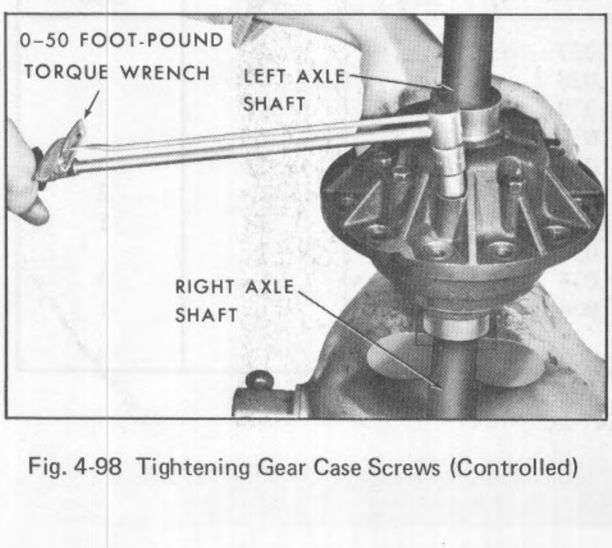


Fig. 4-98 Tightening Gear Case Screws (Controlled)

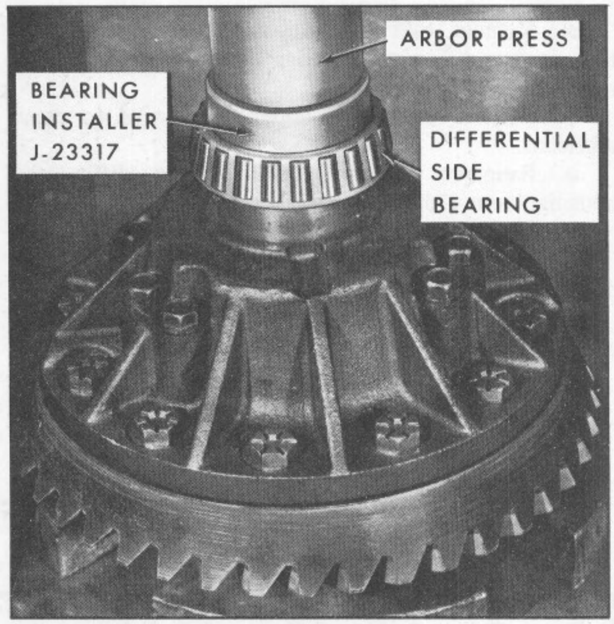


Fig. 4-99 Installing Differential Side Bearings (Controlled)

24. Install gear case on axle shaft with ring gear facing downward.
25. Alternate tightening ring gear bolts to 85 foot-pounds.
26. Remove gear case from axle shaft.
27. Position bearing and Side Bearing Installer, J-23317, and using arbor press, install side bearing on gear case, Fig. 4-99.
28. Repeat Step 27 to install remaining side bearing.

50. Checking Pinion Flange Runout—On Car

1. Position car on hoist so that rear wheels are free to rotate when car is raised.
2. Install wire or fan belt to support propeller shaft, Fig. 4-27, and remove propeller shaft from pinion flange.
3. Using a wire brush, clean pinion flange face and propeller shaft rear flange pilot thoroughly.
4. Remove one pinion retainer screw and install Dial Indicator, J-8001, and Support, J-6126, so that stem touches flange face between mounting bolt holes and pilot diameter, Fig. 4-64. Set dial to zero.
5. Rotate pinion flange by rotating rear wheel one complete revolution and note maximum face runout reading.
6. Install Dial Indicator Extension, J-7057, on dial indicator, and reposition indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-65.
7. Repeat Step 5 to find radial runout. Combined face and radial runout should not exceed .005". Remove dial indicator apparatus and install pinion retainer screw.
8. If runout is satisfactory, re-attach propeller shaft, remove propeller shaft support wire or fan belt, and lower car.
9. If combined runout is not within specification, perform the following procedure in exact sequence:

a. Remove two attaching screws and lockwashers that secure differential carrier nose bumper arm and remove nose bumper arm.

b. Place a drain pan under differential to catch lubricant.

c. Remove pinion assembly from differential housing, Note 47d, Steps 1 through 7.

d. Remove and discard pinion retainer O-ring.

e. Partially disassemble pinion assembly as described in Note 47f, Steps 2 through 11.

f. Remove collapse spacer and install a new collapse spacer on pinion shaft.

g. Re-index pinion flange 90° using alignment mark made on disassembly.

h. Reassemble pinion, following Note 47m Step 9, and Steps 14 through 24.

i. Install pinion assembly, Note 47n, and check runout.

j. Install differential housing nose bumper arm with two screws and lockwashers. Tighten screws to 50 foot-pounds.

k. Install propeller shaft and remove propeller shaft support wire or fan belt.

l. Lower car.

SPECIFICATIONS

Pinion Flange Combined Face and Radial Runout	.005"
Cap Spread	.003" – .004"
Pinion Bearing Preload	
Used Bearings	5 inch-pounds higher than reading found on disassembly, but no higher than 15 inch-pounds total.
New Bearings	22–30 Inch-Pounds
Ring Gear to Pinion Backlash	
Vehicle Mileage Less than 3000	.006" – .008"
Vehicle Mileage Greater than 3000	Re-establish Reading Found on Disassembly

SHIM CHART

PINION SHIM COMBINATIONS

Prod. Size	Service Sizes .010	.007	.006	Prod. Size	Service Sizes .010	.007	.006
.016	1		1	.027	2	1	
.017	1	1		.028	1		3
.018			3	.029	1	1	2
.019		1	2	.030	3		
.020	2			.031	1	3	
.021		3		.032	2		2
.022	1		2	.033	2	1	1
.023	1	1	1	.034	2	2	
.024	1	2		.035	1	1	3
.025		1	3	.036	3		1
.026	2		1				

SIDE BEARING SHIMS

Size	Color	No. of Stripes	Size	Color	No. of Stripes
.1015	Yellow	1	.1185	White	3
.1025	Yellow	2	.1195	White	4
.1035	Yellow	3	.1205	White	5
.1045	Yellow	4	.1215	Green	1
.1055	Yellow	5	.1225	Green	2
.1065	Orange	1	.1235	Green	3
.1075	Orange	2	.1245	Green	4
.1085	Orange	3	.1255	Green	5
.1095	Orange	4	.1265	Pink	1
.1105	Orange	5	.1275	Pink	2
.1115	Blue	1	.1285	Pink	3
.1125	Blue	2	.1295	Pink	4
.1135	Blue	3	.1305	Pink	5
.1145	Blue	4	.1315	Black	1
.1155	Blue	5	.1325	Black	2
.1165	White	1	.1335	Black	3
.1175	White	2	.1345	Black	4

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300-M	Bearing Cap Bolts	7/16–14	50
300-M	Ring Gear-to-Gear Case Bolts	7/16–20	85
280-M	Pinion Retainer-to-Carrier Screws	3/8–16	30
300-M	Gear Case Bolts (Controlled)	5/16–18	30
Special	Carrier Rear Cover Screws	5/16–18	30
275-M	Adjuster Nut Lock Tab Screw (Screw and Washer Assembly).	5/16–18	18
286-M	Pinion Nut	7/8–14	See Pinion Assembly
300-M	Differential Carrier Nose Bumper Arm Screws	7/16–14	50
300-M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16–20	70*
1112	Differential Filler Plug	1/2–14	30

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.)

**CAUTION:* *These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

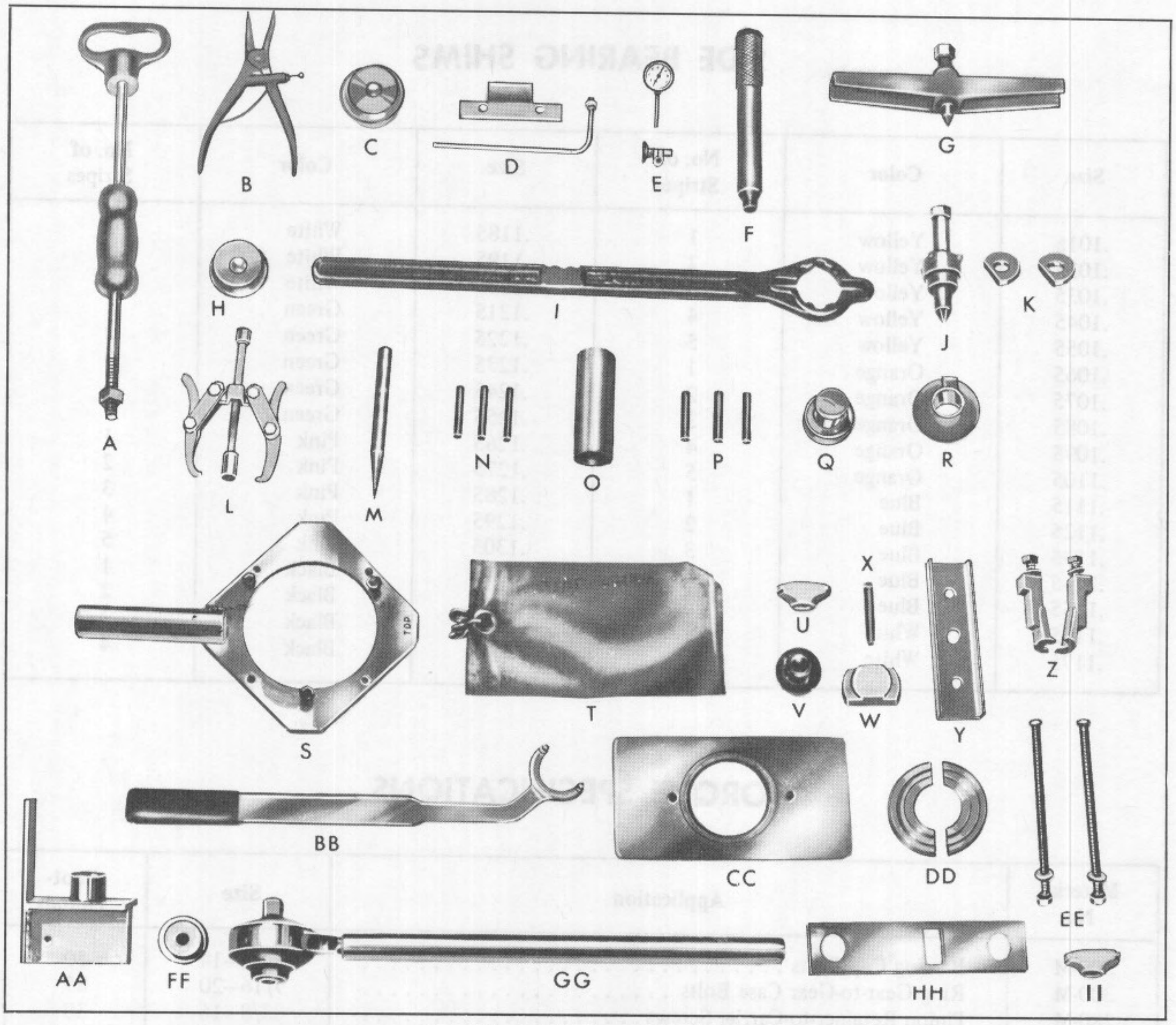


Fig. 4-100 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-2619	Slide Hammer	R	J-23318	Pinion Oil Seal Installer
B	J-4646	Snap Ring Pliers	S	J-23320	Holding Fixture
C	J-6197	Pinion Inner Bearing Cup Installer	T	J-23320-1	Retaining Bag
D	J-23409	Dial Indicator Extension and Support	U	J-23321	Pinion Inner Bearing Cup Remover
			V	J-23322	Straddle Bearing Installer
E	J-8001	Dial Indicator	W	J-23323-5	Straddle Bearing Remover
F	J-8092	Universal Handle	X	J-23323-2	Driver Bolt
G	J-8433-1	Puller Bar	Y	J-23324	Pinion Puller
H	J-8611-1	Pinion Bearing Cup Installer (Outer)	Z	J-23345-1	Bearing Puller Legs
			AA	J-23372	Holding Tool
I	J-8614-1	Pinion Flange Holding Tool	BB	J-23398	Spanner Wrench
J	J-8614-2	Pinion Flange Puller	CC	J-23399-1	Bearing Plate
K	J-21044-5	Spacers	DD	J-23399-2	Bearing Puller
L	J-22888-1	Side Bearing Puller (Controlled)	EE	J-23399-4	Bolts
M	J-23310	Side Gear Aligning Pin	FF	J-23406	Side Bearing Pilot
N	J-23311	Pinion Retainer Guide Pin Set	GG	J-23410	Torque Multiplier
O	J-23314	Pinion Inner Bearing Installer	HH	J-23413	Torque Multiplier Link
P	J-23316-1	Ring Gear Guide Pins	II	J-23671	Pinion Outer Bearing Cup Remover
Q	J-23317	Side Bearing Installer			

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THEORY OF OPERATION

(NOTE: For information pertaining specifically to the Eldorado brake system, refer to the latter portion of this section.)

Single Piston Sliding Caliper Front Disc Brakes (Fig. 5-1)

The major components of the single piston sliding caliper front disc brake mechanism are the hub and disc assembly, the caliper assembly, the shoe and lining assemblies and the splash shield. The hydraulic system also utilizes a combination valve.

a. Hub and Disc Assembly

The cast iron hub and disc assembly is fully ventilated with 35 cooling fins cast integrally between the machined braking surfaces. When the wheel is in motion, the rotation of the disc fins increases the air circulation for more efficient cooling of the unit.

b. Caliper Assembly

The caliper provides a means of applying the shoe and lining assemblies to the disc. It is hydraulically connected to the system by a tube and flexible hose leading from the brake combination valve to each caliper inlet port. It is mounted to the integral steering knuckle by two allen head retainer bolts, two sleeves and four rubber bushings. An inner caliper bushing is installed between each sleeve and groove in the housing, and an outer caliper bushing is installed between each bolt and groove in the housing. Inner and outer shoes and lining assemblies are positioned on the caliper so they straddle the disc.

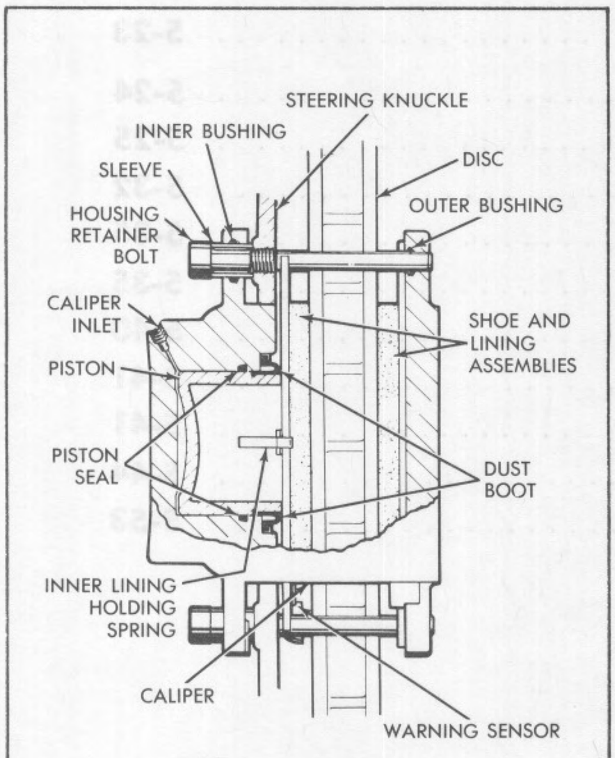


Fig. 5-1 Caliper Cut-Away View

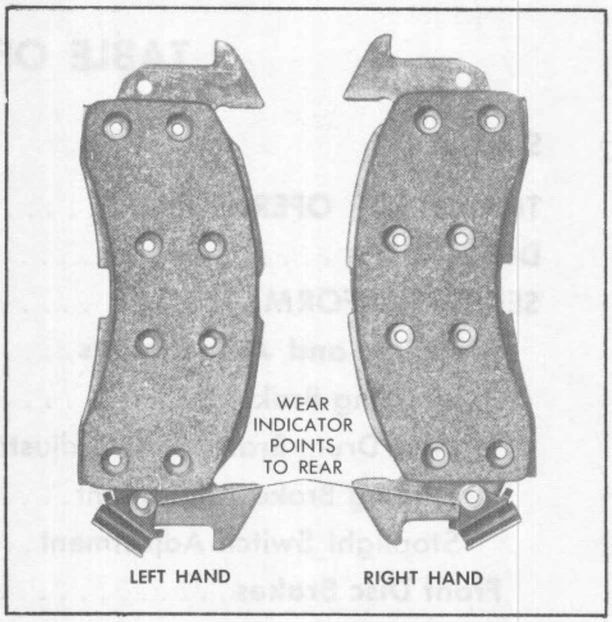


Fig. 5-2 Inboard Disc Brake Shoes

c. Shoe Lining Assemblies

The disc brake linings are attached to the shoes with brass eyelets to form front shoe and lining assemblies.

The inner shoe includes a spring steel wear indicator, Fig. 5-2, which will deliver a squealing or cricket-like warning noise when the linings have reached a point where replacement is necessary. The sound occurs when wheels are turning, but will disappear when the brake pedal is applied firmly.

d. Brake Combination Valve (Fig. 5-3)

The combination valve is located on the frame side rail extension at the left side of the car. The combination valve incorporates three functions as follows:

1. The metering valve (hold-off section) incorporates lines leading to the caliper assemblies.

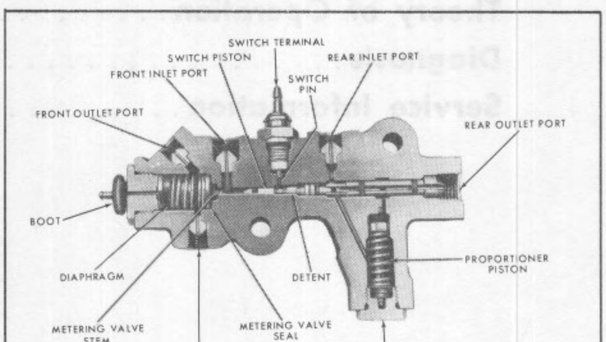


Fig. 5-3 Brake Combination Valve

The purpose of the hold-off valve is to limit pressure to the front disc brakes until the rear drum brakes are activated (rear line pressure must overcome the rear brake shoe return spring tension before the rear brakes actuate).

2. The pressure differential section monitors the front and rear brake systems to measure any difference in pressure from the master cylinder. If a sufficient pressure differential exists between the systems an electrical ground is made energizing the BRAKES tell tale light on the right side of the instrument cluster if the ignition switch is on. The valve and switch are so designed that the switch will latch in the "warning" position once a failure has occurred. The only way the light can be turned off is to repair the failure and apply a pedal force as required to develop up to 450 psi line pressure.

3. The proportioning section of the valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock-up on a vehicle with light rear wheel loads. The valve is designed to have a "by-pass" feature which assures full system pressure to the rear brakes in the event of a front brake system failure.

(NOTE: The brake combination valve on Limousine and Commercial series does not include the proportioning valve section.)

Rear Drum Brakes

The rear drum brake system consists of brake shoes (two per wheel) with riveted composition linings acting on cast iron-steel brake drums. The linings are forced against the drums by hydraulic pressure for normal braking and by a foot lever, through a mechanical linkage to the brake shoes, for the parking brake.

The automatic adjusters can engage when the brakes are applied while the car is moving rearward with light pedal application, or after an uphill stop. Adjustment actually occurs only when there is excessive clearance between the lining and the drum.

Parking Brake

The parking brake pedal assembly is mounted on the cowl to the left of the service brake pedal. The parking brake will release automatically when the transmission selector lever is moved into any drive position with the engine running. It will not release automatically, however, with the engine running and the selector lever in Neutral or Park, or in any position with the engine off.

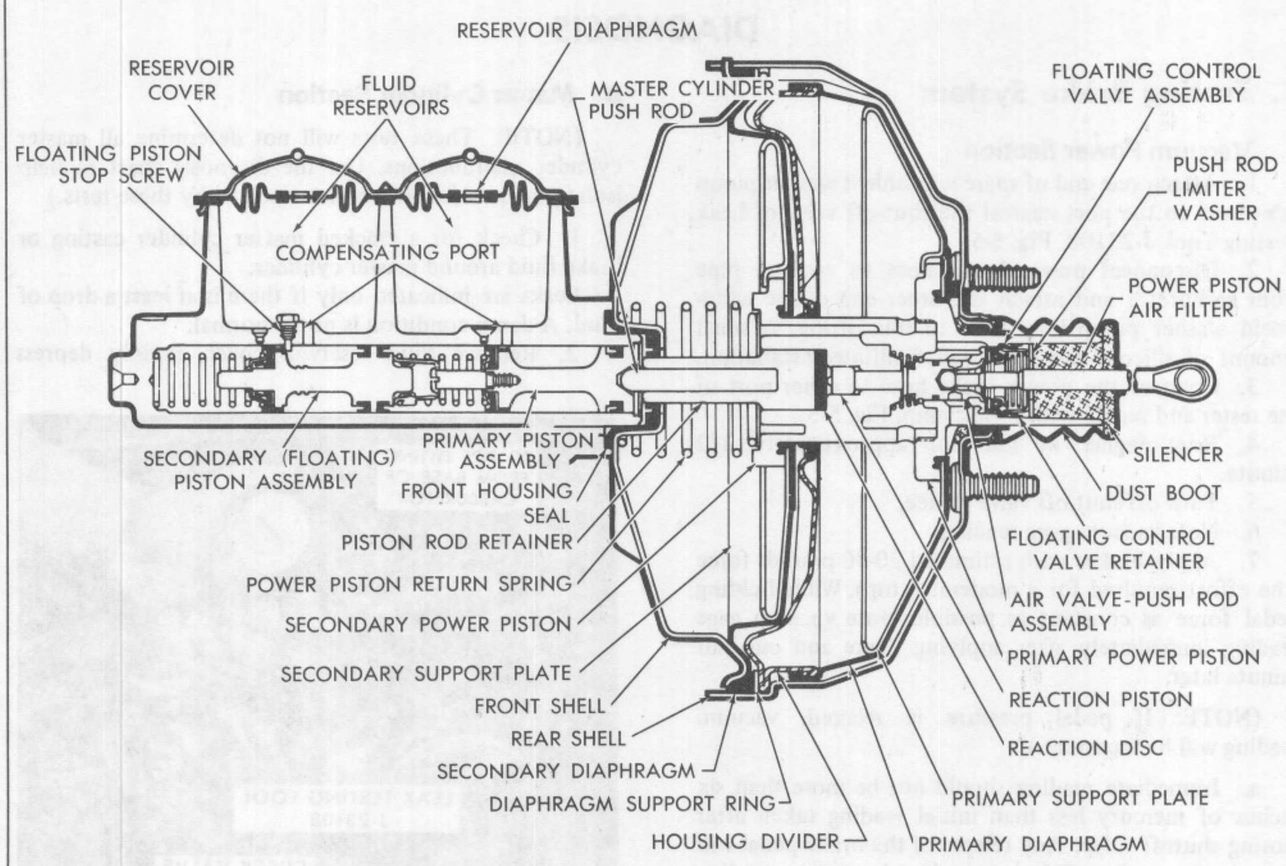


Fig. 5-4 Tandem Diaphragm Power Unit

A manual release lever, located on the inboard side of the parking brake assembly, may be used if the automatic release is inoperative or if manual release is desired at any time.

Tandem Diaphragm Power Brake Unit

The power brake unit used on all cars consists of a tandem diaphragm vacuum power section and a dual hydraulic master cylinder.

The master cylinder is designed so that the front and rear service brakes have separate hydraulic systems. The front section of the master cylinder provides fluid for the front brakes, while the rear section provides fluid for the rear brakes. Should a leak occur in the front hydraulic system, the rear brake system will still function. Likewise, if the rear hydraulic system should develop a leak, then the front system would still function. Increased brake pedal travel and an instrument panel brake light warns the driver that such a condition may have occurred.

The tandem diaphragm vacuum power unit has a vacuum power chamber that consists of a front and rear shell, a housing divider, front and rear diaphragm and plate assemblies, a hydraulic push rod, and a diaphragm return spring, Fig. 5-4.

The unit operates so that the two diaphragm and plate assemblies utilize the differential pressure created by engine intake manifold vacuum and atmospheric pressure to assist the hydraulic push rod.

There are several differences between the tandem unit used on Eldorado series as compared to that used on other models. Therefore, these two units should not be interchanged.

The Eldorado unit utilizes a shorter push rod and specific calibration.

Brake Stoplight Switch

The brake stoplight switch is mounted on a flange on the brake pedal support bracket below the instrument panel. When the brake pedal is depressed, the spring loaded switch plunger follows the brake pedal arm downward until the switch is in the "on" position. When the brakes are released, the arm returns the switch plunger to the "off" position.

Brake Fluid

It is recommended that Part Number 546 4831 brake fluid or equivalent fluids meeting DOT-3 specifications be used in Cadillac brake systems.

Brake fluid should always be stored in closed containers, as it will absorb moisture from the atmosphere. Moisture contamination of brake fluid causes the boiling point of the fluid to be lowered.

DIAGNOSIS

1. Testing Brake System

a. Vacuum Power Section

1. Attach one end of spare windshield washer pump inlet hose to the port nearest the shut-off valve of Leak Testing Tool, J-23108, Fig. 5-5.

2. Disconnect power brake hose to vacuum pipe from carburetor and attach the other end of the windshield washer pump inlet hose to this fitting. A small amount of silicone lubricant will facilitate installation.

3. Connect the power brake hose to other port of the tester and secure with hose clamp, Fig. 5-5.

4. Run engine at idle for approximately 1/2 minute.

5. Turn off shut-off valve on tee.

6. Note vacuum gage reading.

7. Apply brakes with estimated 20-30 pounds force (the effort required for a moderate stop). While holding pedal force as constant as possible, note vacuum gage reading immediately after applying brake and one-half minute later.

(NOTE: If pedal pressure is relaxed, vacuum reading will be incorrect.)

a. Immediate reading should not be more than six inches of mercury less than initial reading taken after closing shutoff valve. Any release of the brake pedal will increase the reading. Subsequent drop in vacuum reading while holding brakes applied should not exceed two inches of mercury per 1/2 minute. If vacuum leak exceeds specification, power unit must be serviced.

b. Master Cylinder Section

(NOTE: These tests will not determine all master cylinder malfunctions. Use the diagnosis chart to help isolate the problem if it is not resolved by these tests.)

1. Check for a cracked master cylinder casting or brake fluid around master cylinder.

Leaks are indicated only if there is at least a drop of fluid. A damp condition is not abnormal.

2. Remove fluid reservoir cover, rapidly depress

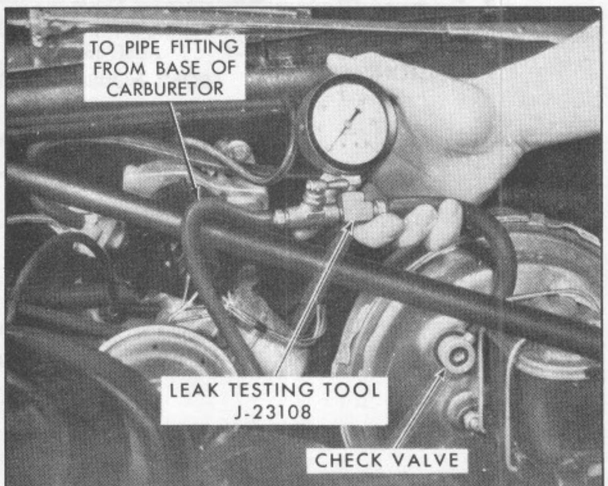


Fig. 5-5 Vacuum Leakage Test

brake pedal. A geyser should be seen at front reservoir as the brake pedal is rapidly depressed.

a. If system fails this test, check for a binding pedal linkage and incorrect push rod adjustment. If both of these are satisfactory, disassemble the master cylinder and check for swollen or elongated primary piston seal(s). Also see Note 3.

c. Brake Combination Valve

1. Metering Valve–Proper operation of the metering valve can be checked by installing pressure brake bleeder using adapter J-22489-1 and cable J-22489-12.

a. With pressure bleeder energized, open bleeder screw on either caliper. No fluid should come out.

2. Distributor Switch–For operational check.

a. Light should be energized during engine cranking.

b. With engine running, apply moderate pedal force, (approximately 20-30 lbs.). When an assistant opens any bleeder screw, light should go ON indicating an open or failed condition.

c. Close bleeder screw before releasing brake.

d. Upon reapplying pedal force, light should go out.

e. Check master cylinder and bring fluid up to proper level, Note 6b.

3. Proportioner Operation (Except 75 and Commercial)

a. Raise car.

b. Remove one of the rear brake bleeder screws and install Pressure Gage Tool J-24657, Fig. 5-6.

c. With engine running at idle and brake pedal applied with 100 lbs. force (approximately the force on each foot when standing) pressure reading should be less than 1,000 psi.

If any of the above specifications are not met, brake combination valve should be replaced.

d. Brake Leaks

1. With engine running at idle and transmission in Neutral, depress brake pedal and hold foot pressure on pedal. If pedal gradually falls away under foot pressure, hydraulic system is leaking.

(NOTE: Hydraulic system may be leaking internally as well as externally. See part b, Steps 1 and 2. Also system may appear to pass this test but still have slight leakage.)

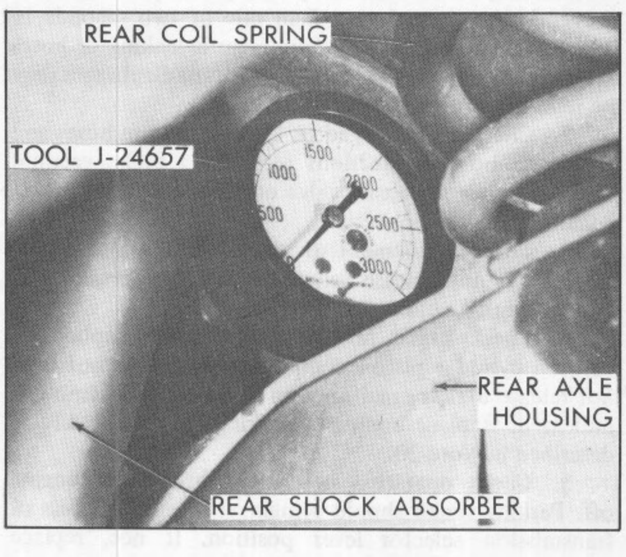


Fig. 5-6 Brake Combination Valve Pressure Gage

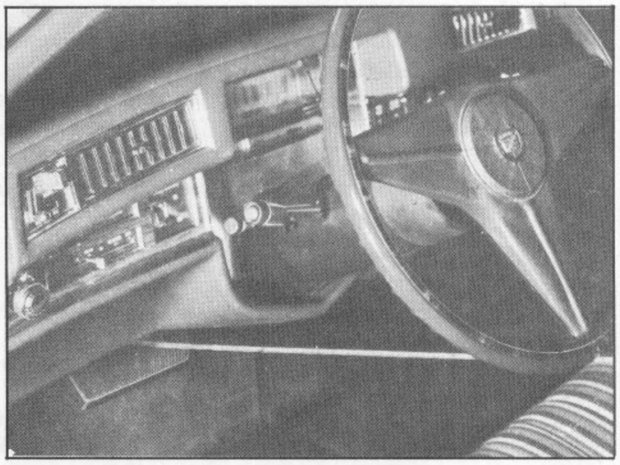


Fig. 5-7 Checking Brake Pedal Height

e. Excessive Pedal Travel

1. On cars equipped with Tilt and Telescope steering column, place wheel in third position from top.

2. Hook end of tape over top edge of brake pedal pad, at approximately the center of the pad.

3. Unreel tape to rim of steering wheel, Fig. 5-7.

4. Place thumbnail at edge of wheel and take a reading of the extended length.

5. While holding tape, and with engine idling, press pedal with estimated 20-30 pounds force (the effort required for a moderate stop), and note reading on tape measure. The difference between the two readings is the amount of pedal travel.

Pedal travel should not exceed 2-1/16 inch.

6. If pedal travel is greater than specification, first drive the car backward and forward to see if the brake pedal height will return to normal. In rare cases, excessive pedal travel develops if the car is not driven in reverse because the self-adjusting mechanism will actuate only in reverse when the brakes are applied.

Most low pedal problems are caused by air in lines, necessitating bleeding of the system. It may be necessary to bleed the system several times at each fitting. See Note 6.

If pedal travel exceeds specification, there may still be some air in the system.

Other less frequent causes of excessive pedal travel are rear brake shoe adjusters not functioning, shoes require relining, front or rear hydraulic system has lost its fluid, and tapered linings.

f. Road Testing Brakes

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light

and heavy pedal forces at various speeds to determine if car stops evenly and effectively.

Also drive car to see if it leads to one side or the other without brake application. If it does, check tire pressure, front end alignment and front suspension attachments for looseness. See diagnosis chart for other causes.

2. Testing Brake Tell-Tale Light Operation

1. Make sure wire is connected to brake combination valve.
2. Start engine, while ignition switch is in start position, brake tell-tale light should glow and go off when ignition switch returns to ignition position.
3. If system performs as described in step 2, and pedal height is satisfactory (part d of Note 1), the system is all right.
4. If light fails to glow in start position, perform electrical tests outlined in Section 12, Note 27d.
5. If light does not go out with ignition switch in ignition position, disconnect wire from assembly. If light still does not go out, proceed as follows:

a. If car is equipped with Track Master, see Page 5-68.

b. If car is not equipped with Track Master, see Section 12, Note 27e.

If light goes out, this indicates that the terminal is shorted or there is a leak in the brake system. Check pedal height (part d of Note 1). If brake light glows and pedal height is low, check for all conditions listed in diagnosis chart on Page 5-7. If it is determined the terminal is shorted, replace the assembly.

(NOTE: The design of the brake combination valve is such that once a brake leak is sensed by the unit, a ground is made within the switch that will not be broken until the leak is corrected. Refer to Note 1-c, Step 2.)

3. Substandard or Contaminated Brake Fluid

Improper brake fluid, mineral oil, or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

When checking the fluid reservoir level, the level in the front reservoir may be as low as one inch from the top if the front linings are worn. This is not abnormal.

To check for deterioration of rubber parts, perform step 2 of Note 1b. If primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of system. Replace all rubber parts in system including hoses. Also when working on the brake mechanisms, check for fluid on linings. If fluid is found, replace linings.

If master cylinder piston seals are all right, check for a leakage or excessive heat conditions. If condition is not found and still in doubt, drain fluid, flush with brake fluid, refill and bleed system, Note 6.

4. Brake Hose Assembly

Each brake hose assembly should be inspected for obvious damage. An assembly should be replaced if a fitting has separated from the hose or if the hose is ruptured, damaged, worn, or blistered.

In the event of damage, the position of the assembly should be observed to determine if the installation was made properly. Check front brake hose by turning the wheel fully in both directions to determine if interference was the cause. Any interference could be the result of a wrong part or improper installation.

If the hose assembly is wet, the area should be dried. The brake system should be actuated and the assembly observed for leakage or presence of fluid. If fluid appears at the connection between the end fitting and the wheel cylinder or frame connection, the assembly should be removed and the hose fitting and the connection inspected for dirt or other foreign material. After cleaning by wiping or use of air hose, the part may be re-installed and the above check repeated. If fluid reappears, replace the part.

If fluid appears on the hose itself or at the junction of the hose and end fitting, the assembly should be replaced.

5. Parking Brake Preliminary Checks

It is not always necessary to replace the parking brake assembly or vacuum diaphragm assembly in cases of an inoperative parking brake automatic release. The following checks should be performed as part of your diagnosis to determine the cause and correction of parking brake trouble and to eliminate unnecessary replacement of parking brake components.

1. Check vacuum cylinder piston travel by running engine and moving transmission selector lever from Drive to Neutral. The manual release lever should move up and down as vacuum is applied and released. If no movement is observed, check vacuum system per steps 2 and 3. If movement is slow, (more than one or two seconds to complete the full stroke) diaphragm is leaking or hoses are partially pinched or kinked. Vacuum diaphragm may be replaced as outlined in Note 21.
2. Check for damaged or kinked vacuum hoses and for loose hose connections at parking brake vacuum cylinder, vacuum release valve at neutral switch, and at engine manifold connection.
3. Check adjustment of neutral switch and operation of vacuum release valve. Correct as necessary and recheck parking brake operation.
4. Check brake release with vacuum applied. If vacuum cylinder piston completes full stroke but does not release brake, a malfunction of the pedal assembly is indicated. Replace complete parking brake assembly as described in Note 20.
5. Check operation of parking brake with engine off. Parking brake should remain engaged regardless of transmission selector lever position. If not, replace parking brake assembly.

BRAKE DIAGNOSIS CHART

NOTE: Operation of Tell-Tale Brake Light may be checked as outlined in Note 28.

CAUSE / Symptom	Excessive Brake Pedal Travel	Brake Pedal Travel Gradually Increases	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Side to Side)	Uneven Braking Action (Front to Rear)	Scraping Noise from Brakes	Brakes Squeak During Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	Brakes Tell-Tale Glows
Leaking Brake Line or Connection	X	XX	X						X						XX
Leaking Wheel Cylinder or Piston Seal	X	XX	X	X				X							X
Leaking Master Cylinder	X	XX	X												X
Air in Brake System	XX		X						X						XX
Contaminated or Improper Brake Fluid	X				X	X	X								X
Leaking Vacuum System			XX		X										
Restricted Air Passage in Power Head		X	X		XX	X									
Damaged Power Head			X	X	X	X	XX								
Worn Out Brake Lining			X	X				X	X	X	X	X		X	
Uneven Brake Lining Wear - Replace	X			X				X	X	X	X	XX		X	X
Glazed Brake Lining - Sand			XX		X			X	X		X	X			
Incorrect Lining Material - Replace			X	X				X	X			X		X	
Contaminated Brake Lining - Replace				XX				XX	XX	X	X	X		X	
Linings Damaged by Abusive Use - Replace			X	XX				X	X	X	X	X		X	
Excessive Brake Lining Dust - Remove with Air			X	XX				XX	XX		X	XX		X	
Heat Spotted or Scored Brake Drums or Discs				X				X	X		X	X	XX	X	
Out-of-Round or Vibrating Brake Drums												X	XX		
Out-of-Parallel Brake Discs	X												XX		
Excessive Disc Run-Out	X												X		
Faulty Automatic Adjusters	X						X	X	X						X
Incorrect Wheel Cylinder Sizes			X	X				X	X						
Weak or Incorrect Brake Shoe Retention Springs				X		X	XX	X	X	XX	X	XX			
Brake Assembly Attachments - Missing or Loose	X						X	X	X	X		X	X	X	
Insufficient Brake Shoe Guide Lubricant							X	X	X	XX	XX				
Restricted Brake Fluid Passage or Sticking Wheel Cylinder Piston		X	X		X	X	X	X	X						X
Improperly adjusted Stoplight Switch or Cruise Control Vacuum Dump							X								
Faulty Metering Valve	X		X	X	X	X	X		X						X
Faulty Proportioning Valve			X	X	X	X	X		X						
Brake Pedal Linkage Interference or Binding			X		X	XX	XX								
Improperly Adjusted Parking Brake							X								
Improperly Adjusted Master Cylinder Push Rod	X					X	XX								X
Incorrect Front End Alignment								XX							
Incorrect Tire Pressure								X	X						
Incorrect Wheel Bearing Adjustment	X									X			X		
Loose Front Suspension Attachments							X	X		XX			X	X	
Out-of-Balance Wheel Assemblies													XX		
Incorrect Body Mount Torque													X		
Need to Slightly Increase or Decrease Pedal Effort														XX	
Operator Riding Brake Pedal			X				X		X					X	
Sticking Caliper or Wheel Cylinder Pistons							XX								

XX – Indicates more probable cause(s)
X – Indicates other causes

SERVICE INFORMATION

(NOTE: For service information pertaining to the Eldorado, refer to the latter portion of this section.)

BLEEDING AND ADJUSTMENTS

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology *"See CAUTION on Page 5-8 prior to Note 6."*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

6. Bleeding Brakes

Bleeding brakes may be made considerably easier through use of one of the pressure brake bleeder tools available. This equipment consists of a tank partially filled with brake fluid and a rubber hose that connects to the hydraulic cylinder reservoir Brake Bleeder Adapter, J-22489-1. Air pressure is applied to the tank to force fluid into the brake system.

Pressure bleeding equipment must be of the diaphragm type. That is, kit must have a rubber diaphragm between the air supply and the brake fluid to prevent air, moisture, oil and other contaminates from entering the hydraulic system.

The Brake Bleeder Adapter, J-22489-1, seals the brake system from atmosphere during the bleeding operation and enables the brakes to be bled with only one hook-up.

a. Pressure Bleeder Method

1. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with fluid.
2. Install Bleeder Adapter, J-22489-1 and cables J-22489-12, on master cylinder and connect bleeder hose to Bleeder Adapter Cover.
3. Install Tool J-23770 so the metering plunger on the front of the brake combination valve is fully depressed.
4. Build up pressure in bleeder to 30 psi or maximum recommended by manufacturer.
5. Back off each master cylinder outlet pipe nut one turn catching fluid displaced from outlets in a cloth or can. Retighten pipe nuts. Discard this fluid.
6. Raise car being careful not to damage pressure bleeder equipment.
7. Perform Steps 8 through 11 in the following sequence as required.
   a. Track master modulator if car is so equipped.
   b. Right rear brake.
   c. Left rear brake.
   d. Right front brake.
   e. Left front brake.
8. Install a box-end wrench on bleeder screw and attach drain hose. Hose discharge end must be submerged in clean brake fluid. Use a clean bottle partially filled with brake fluid.
9. Back off fitting three-quarters turn and bleed brake until there are no more bubbles, then close bleeder screw.
10. Be sure bleeder screw is sealed.
11. Go to the next bleed position in Step 7 and repeat Steps 8, 9, 10 until all positions listed in Step 7 are completed.

(NOTE: Induced pulsation while the bleeder valves are open tends to purge the system and reduce the time necessary to complete the job. This pulsation can be created by pumping the pedal. (1/2" max. travel.)

12. Lower car.
13. Remove Combination Valve Bleeder Retainer, J-23770.
14. Remove pressure bleeding equipment and check reservoir level. Level should be 1/8 inch to 3/8 inch from top.
15. Install master cylinder cover and seal assembly.
16. After bleeding brakes, check pedal travel as described in Note 1, Part e. Rebleed brakes if necessary.
17. Before driving car, be sure a firm pedal is obtained.

b. Manual Bleed Method

If a pressure bleeder is not available the following procedure may be used.

1. Fill both master cylinder reservoirs with brake fluid and install Tool J-23770 on brake combination valve.

(NOTE: Keep reservoirs at least partially filled at all times during bleeding operation.)

2. Back off each master cylinder outlet pipe nut one turn and completely depress brake pedal, catching fluid displaced from outlets in a cloth or can. Retighten pipe nuts before releasing pressure on brake pedal. Discard this fluid. Refill reservoirs.
3. Raise car.
4. Perform Steps 5 through 11 in the following sequence as required.
   a. Track master modulator if car is so equipped.
   b. Right rear brake.
   c. Left rear brake.
   d. Right front brake.
   e. Left front brake.

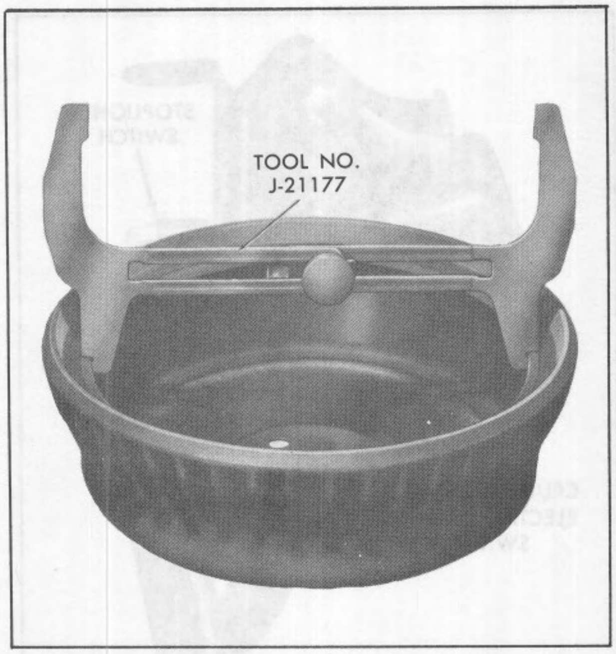


Fig. 5-8 Inside Drum Measurement

5. Install a box-end wrench on bleeder screw and attach drain hose. Hose discharge end must be submerged in clean brake fluid. Use a clean bottle partially filled with brake fluid.

6. Open bleeder screw.

7. Fully depress brake pedal and hold.

8. Close bleeder screw.

9. Release brake pedal.

10. Repeat Steps 5 through 9 until brake fluid, containing no air bubbles, emerges from drain hose. Check and refill the master cylinder reservoir as required to prevent air from being drawn in through the master cylinder.

11. Go to the next bleed position in Step 4 and repeat Steps 5 thru 9 until all positions listed in Step 7 are completed.

12. Lower car.

13. Remove Tool J-23770 from the brake combination valve.

14. Check reservoir level. Level should be 1/8 inch to 3/8 inches from top.

15. Install master cylinder cover and seal assembly.

16. After bleeding brakes, check pedal travel as described in Note 1, Part e.

17. Before driving car, be sure a firm pedal is obtained.

7. Rear Drum Brake Shoe Adjustment

Although the hydraulic service brakes are self-adjusting, a preliminary star wheel adjustment is necessary after the rear brake shoes have been relined or replaced, or when the length of the star wheel adjuster has been changed during some other service operation. Final adjustment is made automatically by adjusters that function when the car is moving backward. No mechanical adjustment is required when replacing front disc brake shoe and lining assemblies.

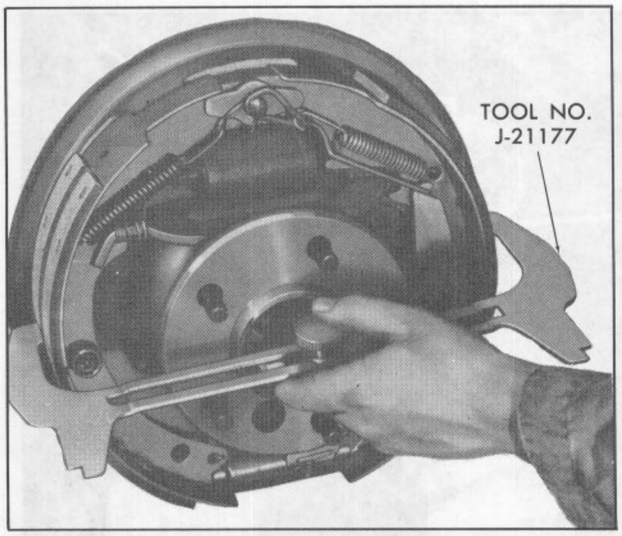


Fig. 5-9 Adjusting Brake Shoes

1. Raise car and remove rear wheels and drums if not already removed.

2. Check to make certain that parking brake cable and linkage, including levers on rear secondary shoes, are free.

3. Measure brake drum I.D. using inside caliper portion of tool J-21177, Fig. 5-8.

4. Adjust brake shoes to dimension obtained on outside caliper portion of tool J-21177, Fig. 5-9.

5. Check brake fluid level in both master cylinder reservoirs. Fluid level should be approximately 1/8 to 3/8 inches below top of reservoir. Add fluid if necessary.

6. Adjust parking brake as described in Note 8.

7. Install drums and wheels. Tighten wheel mounting nuts to 130 foot-pounds. Lower car.

8. Drive car alternately forward and backward, applying brakes moderately in each direction until pedal travel does not exceed specifications listed in Note 1, part d.

CAUTION: When rear brakes are serviced, the parking brake linkage cable at equalizer must always be readjusted to prevent possible burn out of rear brakes.

8. Parking Brake Adjustment

(NOTE: Make sure that rear drum brakes are properly adjusted before adjusting parking brake.)

1. Lubricate parking brake cables at equalizer hooks and under body rub points, and check for free movement of all cables.

2. Depress parking brake pedal approximately 1.0 inch from fully released position, measuring with a ruler.

3. Raise rear wheels off floor.

4. Hold brake cable stud from turning, and tighten equalizer nut, Fig. 5-10, until light drag is felt on either wheel (going forward). After each turn of equalizer nut, check to see if either wheel begins to drag.

5. Release parking brake. No brake shoe drag should be felt at either rear wheel. Operate several times to check adjustment.

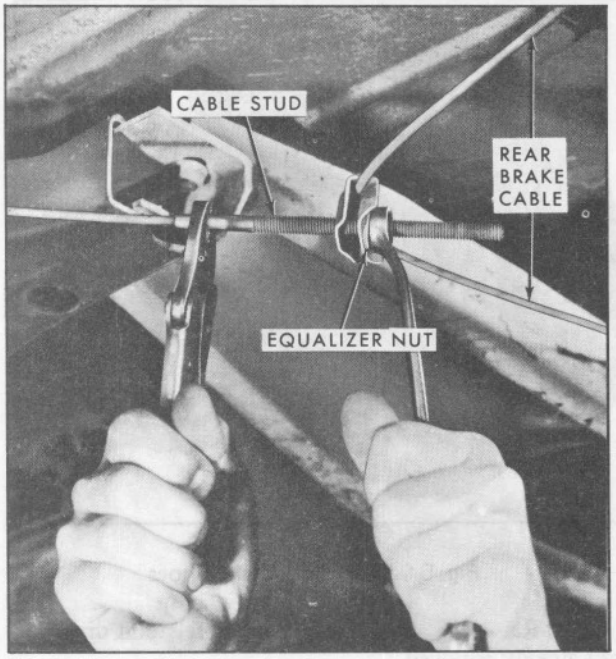


Fig. 5-10 Parking Brake Adjustment

(NOTE: After adjustment is performed, parking brake pedal should travel 2 inches to 3 inches except on Eldorado, and 1 3/4 inches to 2 3/4 inches on Eldorado with approximately 125 pounds force on pedal.)

6. Lower rear wheels.

9. Stoplight Switch Adjustment

The brake stoplight switch and Cruise Control switch are adjusted in an identical manner. Push the switch well into the retaining clip. Pulling the brake pedal fully up to its stop will automatically adjust the switch, Fig. 5-11.

Fig. 5-11 Stoplight Switch Location

Rotate each switch 1/2 turn counterclockwise to be sure that Stoplight and Cruise Control vacuum switches do not hold brake pedal on after adjustment. There should be free play between brake pedal and switch bodies when pedal is pulled toward released direction from unapplied position.

FRONT DISC BRAKES

10. Disc Brake Relining (All)

Lining Inspection

Inspect the brake linings any time that the wheels are removed (tire rotation, etc.). Check both ends of the outboard shoe by looking in at each end of the caliper. These are the points at which the highest rate of wear normally occurs. However, at the same time, check the lining thickness on the inboard shoe to make sure that it has not worn prematurely. Look down through the inspection hole in the top of the caliper to view the inboard shoe. Whenever the thickness of any lining is worn to the approximate thickness of the metal shoe, all shoe and lining assemblies should be replaced.

Front disc brakes have a wear indicator that makes a noise when the linings wear to a degree where replacement is required, (Fig. 5-12). The reed is in an integral part of the inboard shoe and lining assemblies. When the lining is worn the reed contacts the rotor and produces a warning noise.

Check flatness of brake linings. Place inboard and outboard lining surfaces together and check for gap between pad surfaces. If more than .012" gap is measured at middle of linings, linings must not be used. This applies to new or used brake linings.

Relining Procedure

1. Remove two thirds of the total fluid capacity in the front master cylinder reservoir. Discard fluid.

(NOTE: Removing the fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.)

2. Raise car and remove front wheels.
3. Position 7 inch "C" clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-13.
4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.
5. Remove "C" clamp.
6. Remove two bolts, using a 3/8 head Allen Socket Assembly, that hold caliper to steering knuckle, Fig. 5-14.

(NOTE: It is not necessary to remove brake hose when relining disc brakes.)

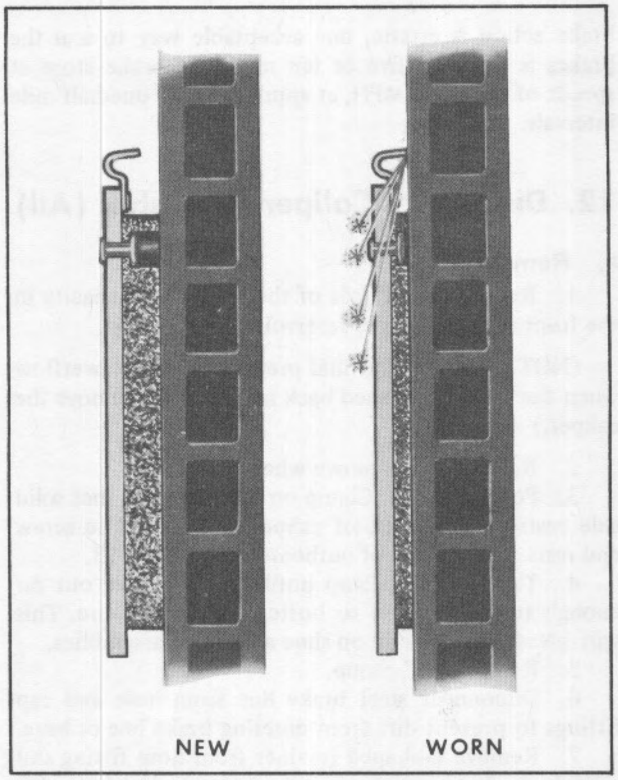


Fig. 5-12 Wear Indicator

7. If working on Eldorado, it will be necessary to remove cotter pin, loosen upper ball joint nut and slip brake hose collar out of its clip. The slack gained will permit removal of caliper without pulling hose.

8. Remove two bolts securing caliper to steering knuckle and slide caliper off disc and support with a hook-shaped wire fastened to upper control arm.

CAUTION: Do not allow caliper to hang from brake hose, as damage may occur.

9. Remove inboard shoe and spring from piston.

10. Remove outboard shoe from caliper.

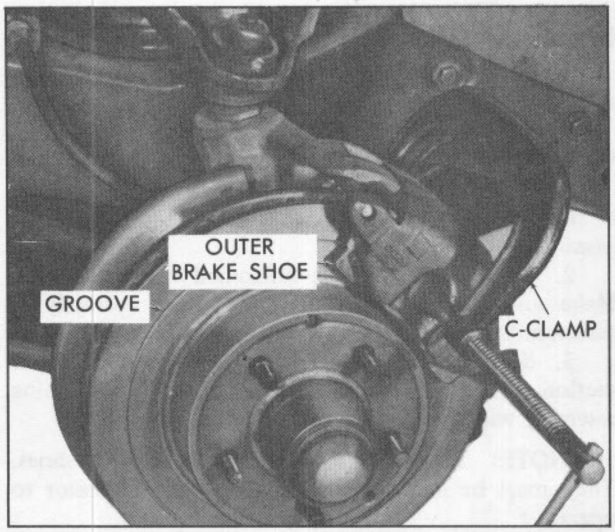


Fig. 5-13 Pushing Piston Into Bore

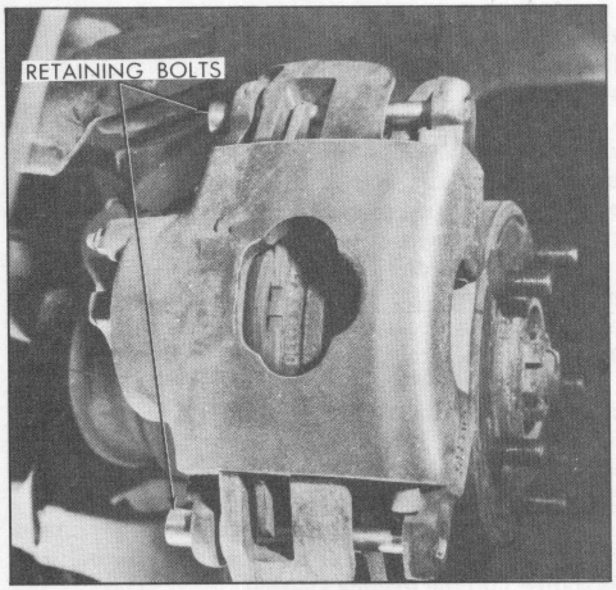


Fig. 5-14 Sliding Caliper Disc Brake

11. Push out two sleeves from inboard ears of the caliper.

12. Remove four rubber bushings, two on inboard ears and two on outboard ears.

13. Examine piston area for fluid leaks by looking for excessive moisture around boot area. Check dust boot for cuts, cracks or other damage which would affect its ability to seal piston bore. If leaks are present or boot shows damage, caliper should be overhauled as described in Note 13. If no defects are found, wipe clean the inside of the caliper including four ears where bushings are installed. Wipe the outside surface of the dust boot clear of all dirt so that when piston is pressed to bottom of bore, boot will fold back without coming out of groove in piston.

CAUTION: Do not use air for cleaning caliper because of the possibility of unseating dust boot.

14. Examine both sides of disc for scoring or rough finish. Refer to Note 15 to determine condition of disc. In normal use, a slight ridge or rust may form on the edge of the disc. This ridge may be removed with sandpaper.

15. Make sure the piston is bottomed in the piston bore. Make sure the dust boot has folded back correctly as the piston moved back.

16. Wipe out grooves in caliper ears and install new rubber bushings.

17. Lubricate new bushings and sleeves with silicone lubricant. Install the sleeves and position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface or the ear.

18. Secure clip-on spring to inner shoe inside cut-out section of piston. Install inboard shoe and lining assembly with wear indicator to rear of car.

(NOTE: With wear indicator there is a specific left hand and right hand inboard shoe.)

19. Place the outboard shoe and lining in the caliper so that the lining faces toward the disc. The two ears at

the ends of the shoe fit over the ears on the caliper. The flange on the bottom of the shoe fits into the cut-out section of the caliper.

20. Position caliper on disc and line up holes in caliper ears with holes in steering knuckle. Make sure the brake hose is not twisted as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.

21. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate both ends of bolts with silicone lubricant.

22. Start either bolt into the inboard ear of the caliper and into the steering knuckle. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-14.

23. Pass the bolt on through the outboard ear on the caliper and brake shoe until the threads on the bolt can be started into the steering knuckle.

24. Repeat steps 22 and 23 in placing remaining bolt into caliper assembly.

25. Tighten caliper mounting bolts, using a 3/8 Allen Head Socket Assembly to 30 foot-pounds.

(For steps 25, 29, 31.) *See CAUTION Page 5-8 prior to Note 6.*

26. Pump brake pedal to seat lining against disc.

27. Clinch upper ear of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear, see Fig. 5-15.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

28. If radial clearance exists, repeat clinching procedure.

29. If working on an Eldorado, center brake hose collar in clip and tighten upper ball joint nut to 60 foot-pounds. Install cotter pin.

30. Repeat steps 3 through 28 on other brake assembly. Always reline both front brakes.

31. Install wheels, tighten wheel mounting nuts to 130 foot-pounds, and lower car.

See CAUTION on Page 5-8.

32. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

33. Allow car weight to be supported on front wheels and inspect front brake hoses for twisted condition. If necessary, correct as described in Note 24a and b.

34. Check the master cylinder reservoirs and fill to 1/8 to 3/8 inch from top.

35. Any time the front brakes are relined, the rear drum brakes should be checked.

36. Break in new linings as described in Note 11.

11. Break-In of New Linings (All)

New or replacement brake linings, if subjected to normal usage at speeds under 50 MPH need no special break-in. However, the first few brake applications may be somewhat erratic, and it may be necessary to stabilize the brakes before delivering the car to the owner. If brake action is erratic, one acceptable way to seat the brakes is to make five or ten moderate brake stops at speeds of 30 to 40 MPH, at approximately one-half mile intervals.

12. Disc Brake Caliper Assembly (All)

a. Removal

1. Remove two thirds of the total fluid capacity in the front master cylinder reservoir. Discard fluid.

(NOTE: Removing fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.)

2. Raise car and remove wheels.

3. Position a "C" Clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-13.

4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.

5. Remove "C" clamp.

6. Disconnect steel brake line from hose and cap fittings to prevent dirt from entering brake line or hose.

7. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket. On Eldorado remove upper ball joint cotter pin and nut. Slide hose clip off ball joint stud. On right side of Eldorado remove clip located at frame side bar and loosen hose at caliper.

8. Remove two bolts, using a 3/8 Allen Head Socket assembly, that hold caliper to steering knuckle.

9. Slide caliper off disc.

10. Remove inboard shoe from caliper.

11. Outboard shoe may have disengaged itself from caliper as caliper was removed from disc. If it did not disengage itself, remove outboard shoe.

12. Place caliper on clean workbench and remove hose and copper washer from caliper inlet fitting. Discard washer.

13. Overhaul caliper as described in Note 13.

b. Inspection of Disc

1. With caliper assembly off disc, inspect disc as described in Note 15.

c. Installation

1. Connect brake hose to inlet hole on caliper using a new copper washer. Tighten to 30 foot-pounds maximum torque.

2. Make sure piston is bottomed in piston bore. Make sure the dust boot has folded back correctly as piston moved back.

3. Secure clip-on spring to inner shoe inside cut-out section of piston. Install inboard shoe and lining assembly with wear indicator to rear of car.

(NOTE: There are left and right inboard shoes. They must be installed properly for wear indicator to operate.)

4. Place outboard shoe and lining in caliper so that lining faces toward disc. The two ears at ends of shoe fit

over ears of caliper. Flange on bottom of shoe fits into cut-out section of caliper.

5. Position caliper on disc and line up holes in caliper ears with holes in steering knuckle.

6. Lubricate both ends of caliper bolts with silicone lubricant.

7. Start either bolt into inboard ear of caliper and outboard ear of shoe into steering knuckle. At this point it is necessary to be sure that bolt passes under retaining ear on inboard shoe to maintain shoe in position in caliper, Fig. 5-14.

8. Pass bolt on through outboard ear on caliper until threads on bolt can be started into steering knuckle.

9. Repeat steps 7 and 8 in placing remaining bolt into caliper assembly.

10. Tighten caliper mounting bolts to 30 foot-pounds.

11. Pump brake pedal to seat lining against disc.

12. Clinch upper ears of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear. Fig. 5-15.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

13. If radial clearance exists, repeat clinching procedure.

14. Install wheel and tighten mounting nuts to 130 foot-pounds torque.

(For steps 10 and 14). See CAUTION on Page 5-8 prior to Note 6.

15. With suspension in normal position (Front wheel straight and vehicle weight on front wheels) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will result in least twist in hose.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.)

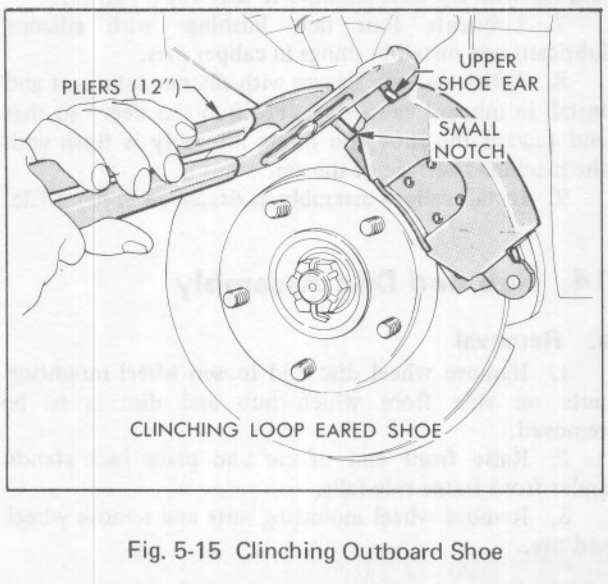


Fig. 5-15 Clinching Outboard Shoe

On Eldorado when assembling front brake hoses at the frame attachment bracket, the front standing height must be set to 13.50 inches as measured along shock absorber from centerline of top mounting bolt to centerline of bottom mounting bolt. Before hose is assembled to bracket.

CAUTION: Hose must not be twisted when assembled as possible damage or interference may occur.

This measurement can be obtained by using Tool J-24842. Insert bottom of tool in lower control arm below shock mounting bracket. Compress suspension and insert top of tool into upper shock mounting bracket, Fig. 5-51.

16. Install U-shaped retainer to secure hose in frame support bracket. On Eldorado install hose and clip on upper ball joint stud. Install nut. Torque to 60 foot-pounds and insert cotter pin.

17. Inspect by turning steering from stop-to-stop while observing hose position. Be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and re-inspect.

18. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.

19. Bleed all brakes as outlined in Note 6.

20. Before moving car, pump brake pedal two or three times to insure a firm pedal.

13. Disc Brake Caliper Disassembly, Cleaning, Inspection and Assembly (All)

a. Disassembly

1. Remove caliper assembly as described in Note 12a.

2. Clean the caliper exterior with denatured alcohol.

3. Push out two sleeves from inboard ears of the caliper.

4. Remove four rubber bushings, two on inboard ears and two on outboard ears.

5. Place a pad of clean shop towels or wood block on caliper bridge, Fig. 5-16.

(NOTE: The towels will prevent damaging the piston when it is pushed out by air pressure.)

6. Use service air hose to apply moderate air pressure to brake fluid inlet hole to force piston out of caliper. Keep fingers clear of piston.

CAUTION: Use clean air only. Air supplies that are lubed or oiled contain mineral oil that will damage rubber parts.

7. Using a screwdriver, pry boot out of housing, being careful not to scratch bore, Fig. 5-17. Discard boot.

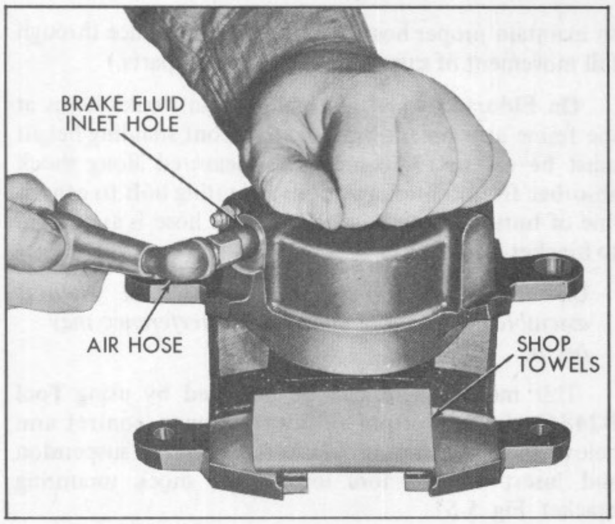


Fig. 5-16 Removing Piston

8. Using a plastic toothpick, remove piston seal from groove in bore and discard seal.

CAUTION: Do not use any metallic device to remove the seal, as it may scratch or damage the bore or groove.

9. Remove bleeder fitting from caliper assembly.

b. Cleaning and Inspection

1. Inspect the caliper brake hose for worn spots, cracks or other signs of deterioration. Replace if necessary.

2. Inspect the piston for scoring, pitting, nicks, corrosion and worn or damaged chrome plating. If any of these faults appear, it will be necessary to replace the piston.

3. The bore should be inspected for the same defects as the piston with the exception of chrome plate. Stains or corrosion can be polished with fine crocus cloth. Wash caliper bore with clean denatured alcohol. If the defects cannot be cleaned up in this manner, it will be necessary to replace the caliper.

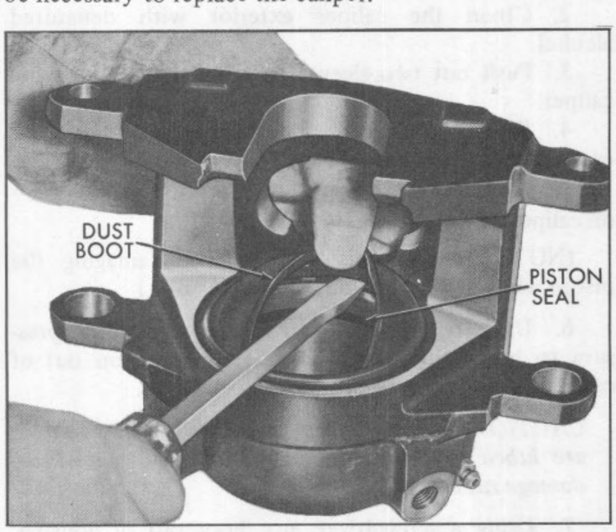


Fig. 5-17 Removing Dust Boot

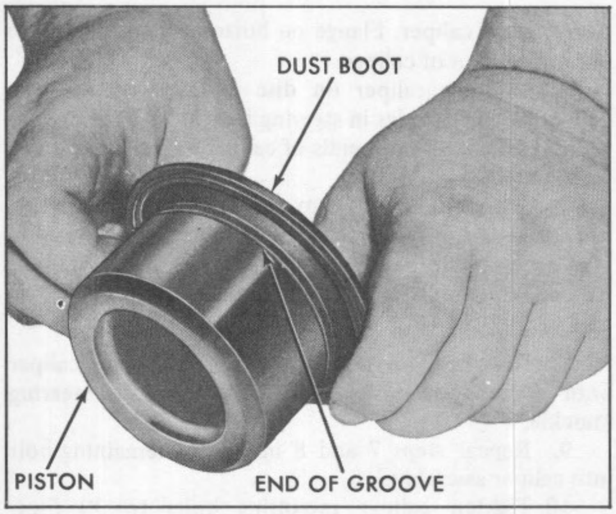


Fig. 5-18 Assembling Dust Boot on Piston

4. All passageways should be blown out with clean air.

5. Clean the caliper mounting bolts and caliper ear grooves of all dirt and corrosion. Do not use abrasives on bolts, as they will remove protective plating.

c. Assembly

1. Install bleeder fitting in caliper.

2. Lubricate pistion bore and new piston seal with brake fluid.

3. Position the new seal in the groove in the piston bore.

4. Assemble new dust boot on piston, so that inner diameter of boot is secured in groove and boot fold faces away from closed end of piston, Fig. 5-18.

(NOTE: Do not use previously removed boot.)

5. Lubricate sealing surface of piston with brake fluid. Position piston in bore and press it down to bottom of bore. Make certain dust boot does not disengage from groove in piston.

6. With dust boot evenly positioned in caliper counterbore, position Boot Installer, J-22904, on boot and tap with a plastic hammer to seat boot, Fig. 5-19.

7. Lubricate four new bushings with silicone lubricant and install bushings in caliper ears.

8. Lubricate new sleeves with silicone lubricant and install in inboard caliper ear. Position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface of the ear.

9. Install caliper assembly as described in Note 12c.

14. Hub and Disc Assembly

a. Removal

1. Remove wheel disc and loosen wheel mounting nuts on side from which hub and disc is to be removed.

2. Raise front end of car and place jack stands under front frame side rails.

3. Remove wheel mounting nuts and remove wheel and tire.

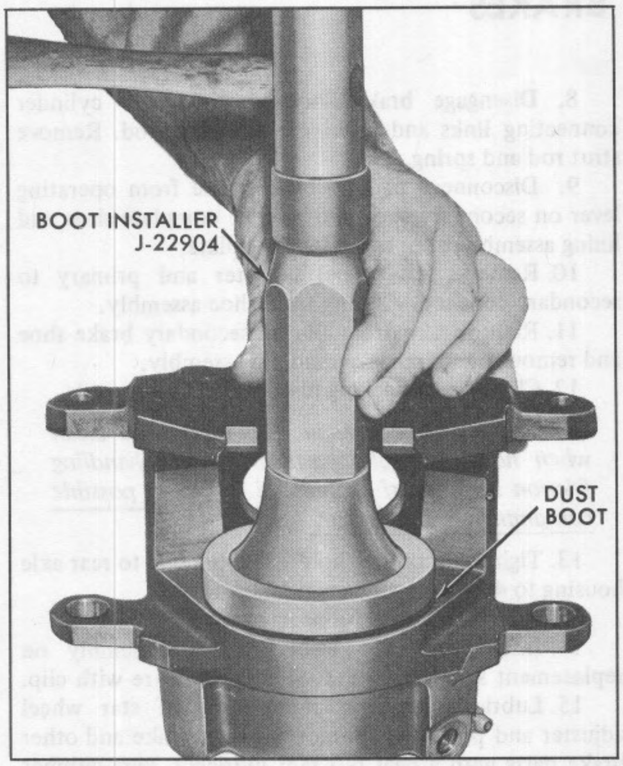


Fig. 5-19 Installing Dust Boot in Caliper

4. Remove two bolts securing brake caliper to steering knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm.

CAUTION: Never allow caliper to hang from brake hose, as damage may occur.

5. Remove dust cap, cotter pin, spindle nut, and washer.
6. Remove outer cone and bearing assembly.
7. Remove hub and disc assembly from steering knuckle spindle.

b. Installation

1. Install hub and disc assembly on spindle.
2. Install bearing assembly, washer and spindle nut, tightening nut with fingers.
3. Adjust wheel bearings as in Section 3 Note 17a.
4. Install caliper following Steps 3 through 10 of Note 12c. Pump brake pedal two or three times to insure a firm pedal.
5. Install wheel and tire and install wheel mounting nuts finger tight.
6. Raise car, remove jack and jack stands, and lower car.
7. Tighten wheel mounting nuts to 130 foot-pounds.
8. Install wheel disc.

15. Servicing Discs

When performing any service on front disc brakes, inspect the disc ventilation passages for obstructions, such as salt or mud build-up. Any build-up must be removed because it decreases brake cooling, which might lead to increased lining wear rate and brake shudder.

When new linings are installed, the disc should be lightly sanded using a circular non-directional motion. A slight ridge of rust may form on the edge of the disc, during normal use. This ridge should be removed during the sanding operation.

Scoring of the disc, due to advanced wear of linings, does not always necessitate replacement of the disc. Discs with scoring of the surface up to approximately .020 inch in depth are not detrimental to brake operation and may be used with new linings.

Once a wear pattern has been established, front disc brake cars are not as susceptible to problems occurring because of scored discs as front drum brake cars are due to scored drums.

In normal servicing of worn lining or on caliper removal, lateral runout of the disc need not be checked, except when brake shudder is evident.

If brake shudder develops after long periods of use, it may be caused by light surface deposits (such as lining oxides) on the braking surface of the disc. These deposits, which appear as a dark blotch about the size of half-dollars, may be removed by sanding.

Brake shudder may be caused by excessive disc lateral runout or out-of-parallelism.

Before checking runout and parallelism, check disc thickness. If total disc thickness is less than 1.215 inch on all except the Eldorado or 1.190 inch on the Eldorado, the disc must be replaced. Some discs may already be at minimum thickness, so the disc must be checked before attempting a refinishing operation.

When checking runout of the "C" car, first tighten front wheel bearing to take up end play. If "C" car lateral runout is in excess of .005 inch, or parallelism is in excess of .0005 inch, the disc should be refinished or replaced.

On the Eldorado, lateral runout of the hub and disc assembly must not exceed .008 inch or parallelism .0005 inch. If these specifications are exceeded, the disc should be refinished or replaced. When checking runout on this car, the wheel nuts must be installed with the flat portion of the hex against the disc to retain the disc against the hub.

The hub and disc assembly (except Eldorado), is a cast integral unit and is not interchangeable with the Eldorado hub and disc. The Eldorado hub and disc are replaceable separately. On all cars it is not necessary to replace both front hub and disc assemblies when only one is defective. Replace only defective hub and discs.

Since extremely accurate control of the finishing operation is necessary for proper performance, refinishing of the rubbing surface is not recommended unless precision equipment is available and surfaces can be held within specifications listed.

REAR DRUM BRAKES

16. Rear Drum Brake Shoe Assemblies

When brake relining is necessary, it is recommended that the complete brake lining and shoe assemblies be replaced with new assemblies. New lining and shoe assemblies are precision-ground to fit the drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings and drum.

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Distribution Center. Brake lining grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

17. Relining Rear Drum Brakes (All Except Eldorado) (Fig. 5-20)

1. Release parking brake, raise car, and remove rear wheels.
2. Remove rear brake drum assemblies.
3. Loosen parking brake cable locknut on equalizer.
4. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.
5. Disconnect link at anchor and remove link, secondary brake shoe retracting spring, and anchor plate.
6. Remove primary brake shoe hold-down cup, spring and pin, and secondary brake shoe hold-down pin, cup, spring, and sleeve.
7. Remove pawl return spring, actuating lever, and pawl.

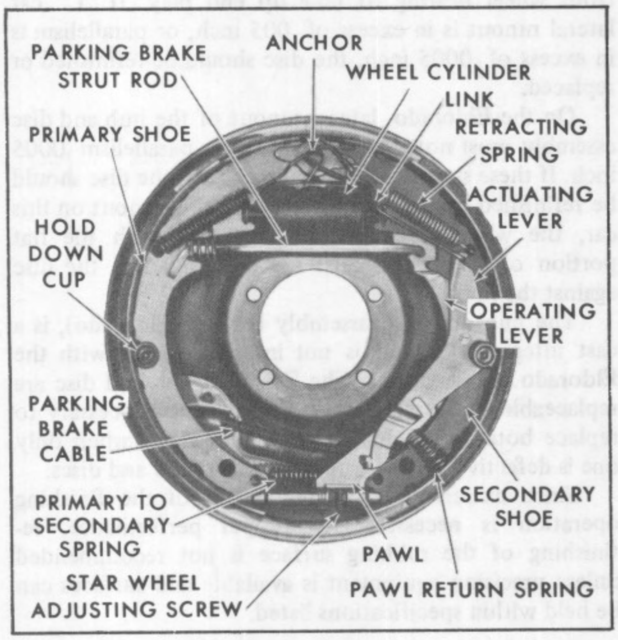


Fig. 5-20 Rear Wheel Drum Brake Mechanism

8. Disengage brake shoes from wheel cylinder connecting links and parking brake strut rod. Remove strut rod and spring.
9. Disconnect parking brake cable from operating lever on secondary shoe and remove complete shoe and lining assembly from brake backing plate.
10. Remove star wheel adjuster and primary to secondary connecting spring from shoe assembly.
11. Remove clip from pin on secondary brake shoe and remove operating lever and pin assembly.
12. Clean brake backing plate and all brake parts.

CAUTION: Make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings as possible contamination may occur.

13. Tighten nuts that hold backing plate to rear axle housing to 40 foot-pounds maximum torque.

See CAUTION page 5-8 prior to Note 6.

14. Install operating lever and pin assembly on replacement secondary brake shoe and secure with clip.
15. Lubricate threads and socket of star wheel adjuster and points of contact between brake and other brake parts with a heat resistant lubricant, part number 545 0032 or its equivalent. Use sparingly, especially on brake shoe pads.
16. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.
17. Install star wheel adjuster and primary-to-secondary connecting spring on brake shoes. Make certain that star wheel rotates in proper direction.

(NOTE: Maroon springs are used on both left and right hand rear brake shoe assemblies. These springs are interchangeable.)

Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand threads) Fig. 5-21 are installed on right side of car and those with three narrow grooves on O.D. of pivot nut (right hand threads) must be installed on left side.

18. Position shoe assembly on brake backing plate and connect parking brake cable to operating lever.

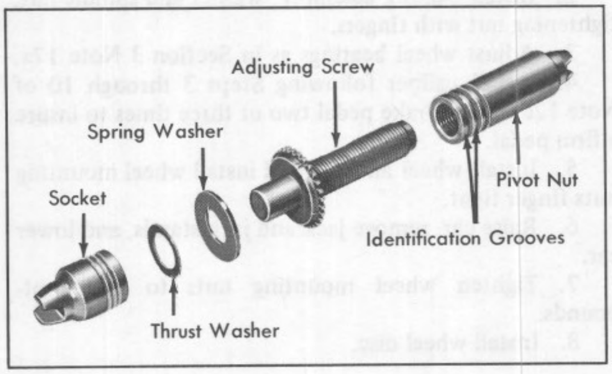


Fig. 5-21 Star Wheel Adjuster Disassembled

19. Install parking brake strut rod and spring on brake shoe assembly.

(NOTE: Light blue spring is used on left side and white spring on right side. These springs are not interchangeable. Spring tab must be positioned outside of brake shoe web on both rear brakes.)

20. Engage shoes with wheel cylinder connecting links and install hold-down pin, cups, and spring on primary brake shoe.

(NOTE: Maroon primary and blue secondary hold-down springs are used on the rear brake assemblies.)

21. Position actuating lever and pawl so that actuating lever is on top of secondary brake shoe. Secure with hold-down pin, sleeve, spring, and cup.

22. Install anchor plate, link, and secondary brake shoe retracting spring (yellow). For easiest installation, first connect spring to link then install link on anchor, using brake Spring Remover and Installer, J-8049.

23. Install pawl return spring. Make certain that star wheel engages pawl.

24. Install primary brake shoe retracting spring (red) using Spring Installer, J-8049.

25. Perform preliminary service brake adjustment as described in Note 7.

26. Install rear brake drums on rear axle shaft flange and secure with screw.

27. Install wheels on brake drums. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION page 5-8 prior to Note 6.

28. Adjust parking brake as described in Note 8.

18. Machining Brake Drums

a. Warped or Scored

Brake drums should be carefully checked to see if they have become warped or scored excessively. If they appear salvageable and if suitable equipment is available, they can be machined.

Drum machining is a precision operation. Equipment used for this purpose must be capable of maintaining the close limits specified. Be sure to install drum in the machining equipment correctly and to check runout of lathe spindle to insure accuracy of final machining operation. Inside drum diameter must not be machined over 12.060 inches on all cars except the Eldorado or 11.060 inches on the Eldorado. Should brake drums be machined too thin, the intense heat that develops under severe driving conditions will cause them to distort, crack or warp.

In addition, the specifications listed on page 5-31 for all cars except the Eldorado or page 5-44 for the Eldorado must be held.

Replacement brake drums supplied by your servicing Parts Warehouses are machine-finished at the factory before being shipped. They do not require any further finishing before installation, but they must be thoroughly cleaned with a non-oil base solvent to remove all traces of the oil or grease used for rust-proofing during storage and transit. Do not machine drums to roughen the braking surface. Use coarse emery cloth for this purpose.

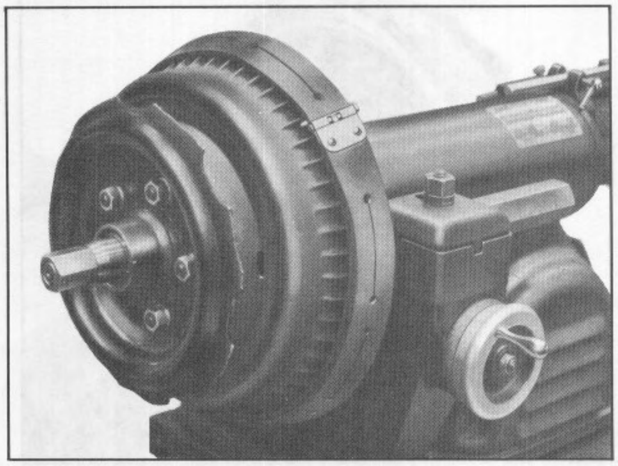


Fig. 5-22 Assembly Mounted on Lathe

b. Brake Shudder (All Except Eldorado)

Brake shudder may be experienced during light pedal application just as the car is braked to a stop. The shudder, sometimes called "footballing", chatter, or surge, may be caused by improper fit of the rear brake drum to the rear axle shaft, resulting from the mounting face of the drum being out-of-flat.

The out-of-flatness and resultant roughness or "footballing" condition of the rear brake drums can usually be eliminated by turning the suspected drum while it is clamped between a front wheel hub and a wheel spider assembly. (Fig. 5-22)

The entire procedure for drum-turning is as follows:

1. Wipe drum inner mounting surface and front hub surface clean of all metal chips, dust or foreign matter.

2. Install drum causing roughness or shudder between front hub, and wheel spider section, Fig. 5-23 securing with five wheel attaching nuts. Torque nuts to 50 foot-pounds, using a criss-cross pattern of tightening.

3. Turn drum on a lathe in usual manner that a front drum would be turned, Fig. 5-24.

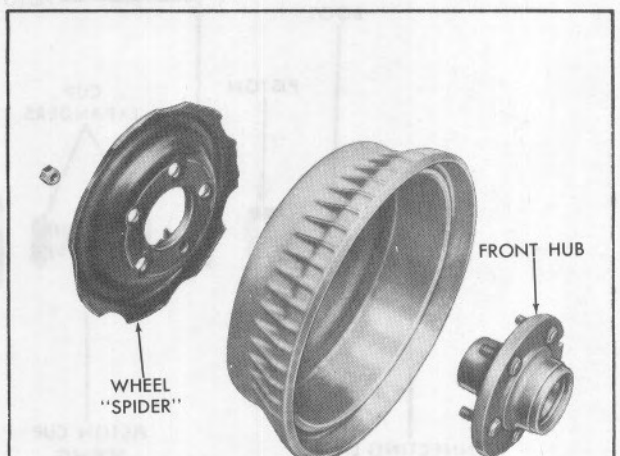


Fig. 5-23 Assembling Spider & Hub To Drum

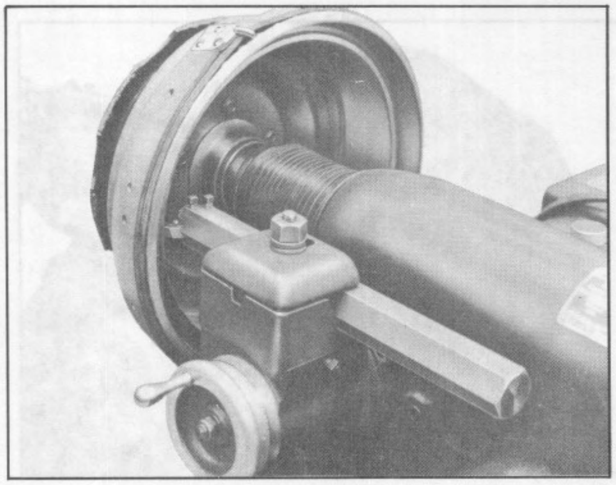


Fig. 5-24 Turning Drum

4. After turning drum, unbolt assembly and remove drum. Drum is now ready for installation on car and roadtesting to confirm correction of brake roughness or shudder.

This procedure can be used for all Cadillac rear drums that exhibit brake shudder, and all past model front drums regardless of the make of drum.

(NOTE: Front drums of past models have the hub assembled so only the wheel spider need be mounted on these drums before turning.)

Though the front wheel, tire, hub and drum of past models can be removed from the car as an assembly and turned as an assembly on some lathes, it is recommended the tire and wheel assembly be removed from the drum, and the wheel spider be installed before turning. This permits greater ease of handling and places less weight on the drum lathe spindle bearings.

19. Wheel Cylinder Servicing

a. Removal

1. Raise car and remove wheel and brake drum. Vacuum out dust and dirt from drum and linings.
2. Disconnect hydraulic brake piping from wheel cylinder.
3. Remove brake shoe retracting springs and link.
4. Remove two screws holding wheel cylinder to backing plate.
5. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinder.

CAUTION: Be sure brake fluid does not drip on brake lining, as fluid may damage linings.

b. Disassembly (Fig. 5-25)

1. Remove connecting links and rubber boots from ends of wheel cylinder.
2. Slide pistons and piston cups from either end of cylinder.
3. Remove piston cups, spring and expander assembly.
4. Remove bleeder screw assembly.

c. Cleaning and Parts Replacement

With clean hands, wash all parts except pistons in clean alcohol. Wipe pistons with clean dry cloth. Inspect surface of cylinder bore and hydraulic passages. Replace wheel cylinder if any obstructions are observed in holes or if there are any nicks or burrs in bore.

If it is necessary to replace any of the wheel cylinder assembly parts, refer to parts book for replacement parts.

d. Assembly (Fig. 5-25)

1. Install bleeder screw assembly.
2. Install piston cup in one end of cylinder with lip toward center, and install piston with flat side toward cup.
3. Install rubber boot into end of wheel cylinder.
4. Install spring and expander assembly.
5. Install other piston cup, lip toward center. Install piston, flat side toward cup.
6. Install remaining rubber boot into end of cylinder.

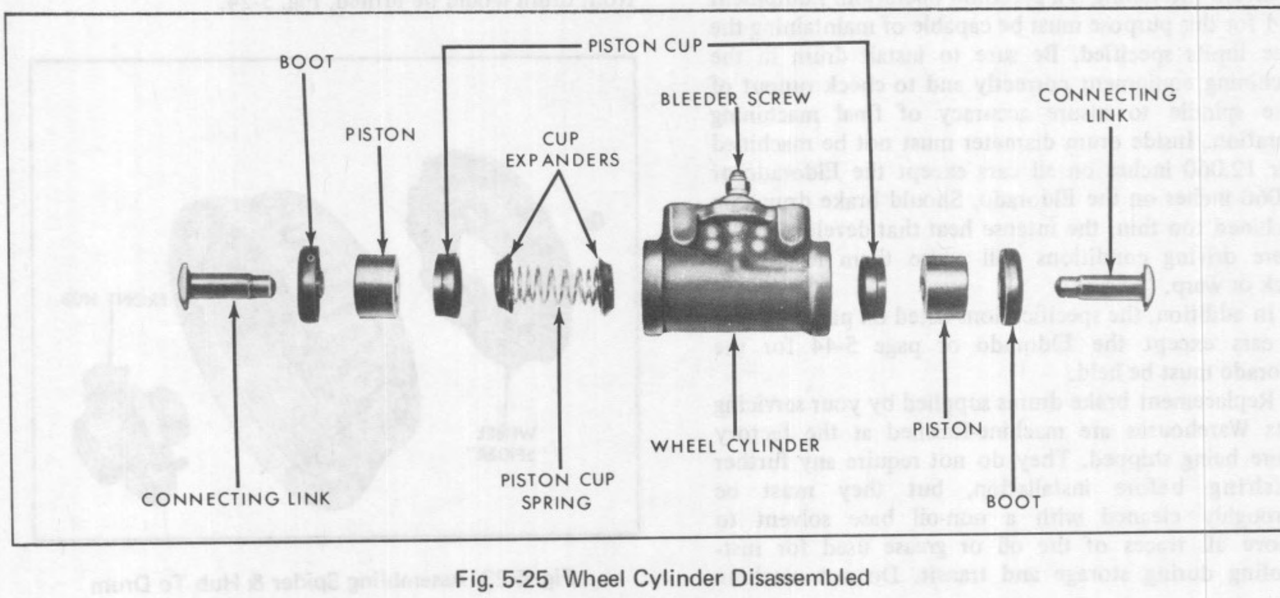


Fig. 5-25 Wheel Cylinder Disassembled

e. Installation

1. Position wheel cylinder on brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.

2. Install two screws holding wheel cylinder to backing plate. Tighten to 15 foot-pounds maximum torque.

See CAUTION on page 5-8 prior to Note 6.

3. Install brake shoe retracting springs and link.

(NOTE: Avoid handling friction surfaces of drums and linings.)

4. Connect brake piping to wheel cylinders.

5. Install brake drum and wheel assembly and torque wheel lug nuts to 130 ft. lbs.

6. Bleed all brakes as described in Note 6.

20. Parking Brake Pedal Assembly

a. Removal

1. Remove steering column lower cover as explained in Section 12, Note 41a.

2. Place parking brake pedal in release position. Set transmission shift lever in Park position.

3. Working underneath car, remove equalizer nut and washer and separate cable stud from equalizer.

4. Disconnect parking brake vacuum hose at cylinder.

5. Position carpet and left cowl kick-pad out of the way.

6. Working from under hood remove two parking brake assembly-to-cowl mounting nuts.

7. Remove one parking brake assembly-to-instrument panel mounting bolt and move assembly away from cowl.

8. Position brake pedal lever so that clevis on parking brake assembly is exposed, and remove brake cable end from clevis.

b. Installation

1. Position parking brake pedal so that clevis is exposed, and attach parking brake cable to clevis on parking brake assembly.

2. Install parking brake assembly and secure to cowl with two mounting nuts.

3. Install one parking brake assembly-to-instrument panel mounting bolt.

4. Connect hose to parking brake vacuum cylinder.

5. Replace cowl kick-pad and carpet.

6. Insert cable stud through equalizer, making sure the center cable is properly routed through equalizer and secured at C-shaped clamp, Fig. 5-26.

7. Install washer and equalizer nut.

8. Adjust parking brake as described in Note 8.

9. Check operation of automatic release.

10. Install steering column lower cover, as explained in Section 12, Note 41b.

21. Parking Brake Vacuum Diaphragm

a. Removal

1. Remove parking brake pedal assembly as described in Note 20a.

2. Drill out one rivet that retains cylinder and bracket to parking brake assembly.

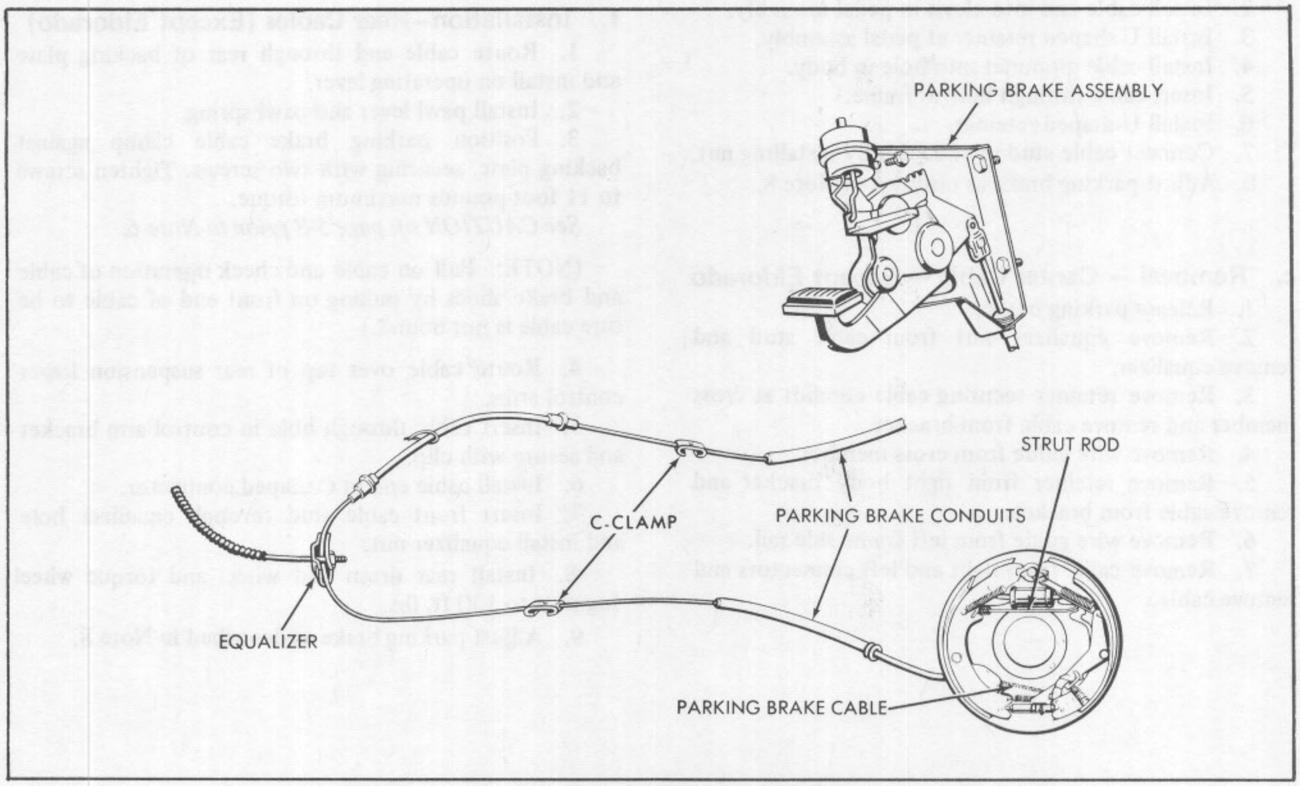


Fig. 5-26 Parking Brake Linkage

3. Detach link that connects cylinder to manual release lever and remove cylinder.

b. Installation

1. Position cylinder and bracket on parking brake assembly and secure with one rivet or bolt and nut.
2. Secure link to manual release lever.
3. Install parking brake assembly as described in Note 20b.
4. Test lock and automatic release operations with engine running in Neutral and Drive ranges.

(NOTE: Parking brake should release in any drive range with engine running, and should remain engaged in Neutral and Park with engine running.)

22. Parking Brake Cables (Fig. 5-26)

a. Removal (Front Cable)

1. Release parking brake.
2. Disconnect cable stud at equalizer by removing equalizer nut and separating cable stud from equalizer.
3. Remove U-shaped retainer at frame.
4. Remove U-shaped retainer at pedal assembly.
5. Remove cable end from parking brake assembly clevis.
6. Pull cable through hole in frame and remove from car.

b. Installation (Front Cable)

1. Insert cable through hole in body.
2. Install cable end into clevis in pedal assembly.
3. Install U-shaped retainer at pedal assembly.
4. Install cable grommet into hole in body.
5. Insert cable through hole in frame.
6. Install U-shaped retainer.
7. Connect cable stud at equalizer by installing nut.
8. Adjust parking brake as outlined in Note 8.

c. Removal – Center Cable – Except Eldorado

1. Release parking brake.
2. Remove equalizer nut from cable stud and remove equalizer.
3. Remove retainer securing cable conduit at cross member and remove cable from bracket.
4. Remove wire guide from cross member.
5. Remove retainer from right body bracket and remove cable from bracket.
6. Remove wire guide from left frame side rail.
7. Remove cable from right and left connectors and remove cable.

d. Installation – Center Cable – Except Eldorado

1. Install cable in right and left connectors.
2. Install wire guide securing cable to left frame side rail.
3. Install cable conduit in right body bracket and secure with retainer.
4. Install wire guide securing cable conduit at cross member.
5. Install cable conduit in bracket at cross member and secure with retainer.
6. Install cable in equalizer and secure to cable stud with nut.
7. Adjust parking brake as described in Note 8.

e. Removal – Rear Cables (Except Eldorado)

1. Release parking brake.
2. Raise rear of car and place on jack stands.
3. Remove rear wheel and drum on same side of car as parking brake cable being replaced.
4. Remove equalizer nut and separate equalizer from front cable stud.
5. Remove end of cable being replaced from C-connector.
6. Remove clip securing cable to control arm bracket and remove cable from bracket by pulling rearward.
7. Remove two screws securing parking brake cable clamp to brake backing plate.
8. Remove pawl spring and pawl lever from actuating lever.
9. Remove cable end from operating lever, and remove cable from backing plate.

f. Installation–Rear Cables (Except Eldorado)

1. Route cable end through rear of backing plate and install on operating lever.
2. Install pawl lever and pawl spring.
3. Position parking brake cable clamp against backing plate, securing with two screws. Tighten screws to 11 foot-pounds maximum torque.

   See CAUTION on page 5-8 prior to Note 6.

(NOTE: Pull on cable and check operation of cable and brake shoes by pulling on front end of cable to be sure cable is not bound.)

4. Route cable over top of rear suspension lower control arms.
5. Insert cable through hole in control arm bracket and secure with clip.
6. Install cable end in C-shaped connector.
7. Insert front cable stud through equalizer hole and install equalizer nut.
8. Install rear drum and wheel and torque wheel lug nuts to 130 ft. lbs.
9. Adjust parking brake as described in Note 8.

HYDRAULIC LINES

23. Brake Combination Valve (Except Eldorado)

a. Removal

1. Disconnect wiring connector from valve.
2. Disconnect three brake pipes from top and one from front of valve.
3. Raise car and disconnect remaining brake pipe from bottom of valve.
4. Remove two bolts securing valve to frame and remove valve.

b. Installation

1. Position valve to frame and secure with two bolts.
2. Install brake pipe to bottom of valve.
3. Lower car.
4. Install one brake pipe to front of valve and three on top.
5. Connect wiring connector to valve.
6. Bleed brakes as described in Note 6.

(NOTE: When replacing a combination valve, rear brake bleeding can be accomplished by allowing brake fluid to flow from the rear brake pipe nut at the valve. Back off this nut one turn and catch fluid flow in a cloth or a container until air is eliminated.

The front brakes should be bled at the calipers in the usual manner. Then, before driving car be sure a firm pedal is obtained.)

24. Servicing Hydraulic Brake Hoses and Piping—(All Except Eldorado, Fig. 5-27)

The brake system should be checked visually each time the car is lubricated. When the car is raised on a lift for lubrication, brake lines, hoses, and cables should be inspected for proper attachment, leaks, cracks, chafing, deterioration, etc.

The brake hoses should be carefully inspected for cracks in the rubber cover (360° around) at either end of the hose near the fittings by flexing the hose while inspecting it. Adequate lighting and a mirror are essential tools for a good inspection. This inspection is made easier by steering the wheels to a full turn and/or removing the front wheels. If any cracks, chafing, or leaks of the brake hose are detected, the brake hose should be replaced.

a. Removal—Hydraulic Brake Hose (Front Wheels)

1. Disconnect steel brake line from hose. Cap fitting to prevent dirt from entering brake line.
2. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket.
3. Turn hose fitting out of caliper inlet and remove copper gasket. Discard gasket. If hose is to be reinstalled, cover end fittings to prevent dirt from entering hose.

b. Installation—Hydraulic Brake Hoses (Front Wheels)

1. Install new copper gasket on caliper end of hose (male end). Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in caliper inlet with hose attached at frame ends as this will twist the hose and could cause damage.

2. With suspension in normal position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position.

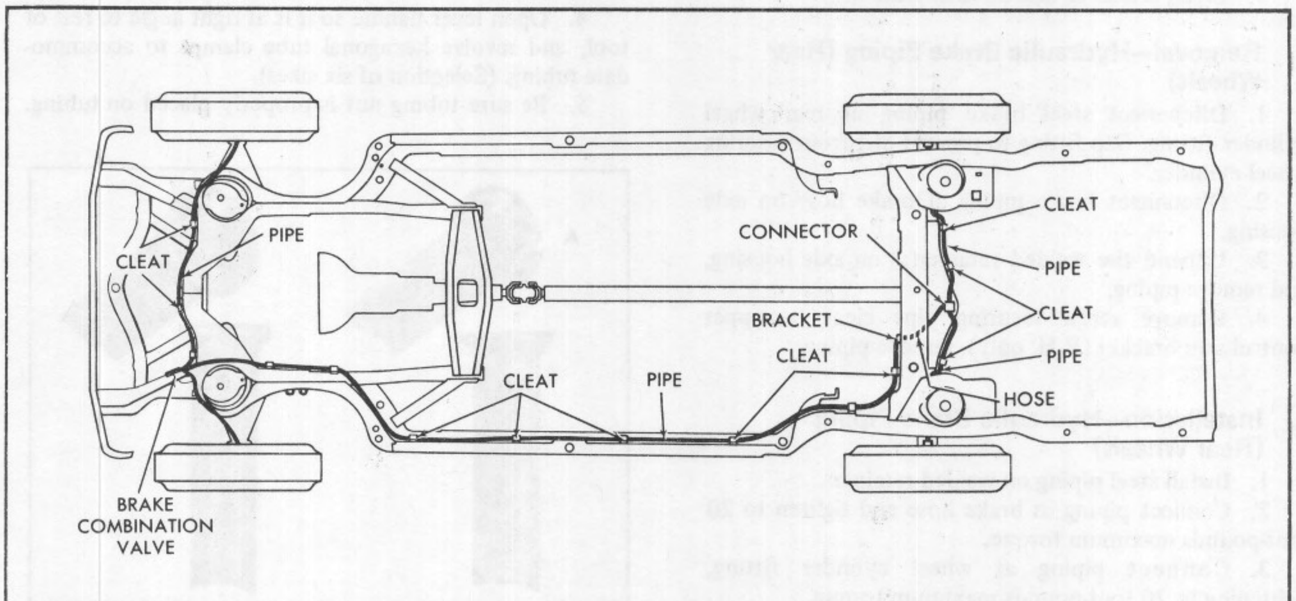


Fig. 5-27 Hydraulic Brake Lines

Insert hex of hose fitting into the 12-point hole in support bracket in position that will require the least twist in hose.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.)

3. Install U-shaped retainer to secure hose in frame support bracket.

4. Inspect by turning steering from stop-to-stop while observing hose position be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and reinspect.

5. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.

6. Bleed all brakes as outlined in Note 6.

c. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Disconnect brake pipes from hose. Cap pipes to prevent entry of dirt or foreign matter into system.

2. Remove retainer securing forward end of hose to frame or bracket.

3. Remove screw securing hose to axle bracket.

d. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Thread rear axle pipes into hose.

2. Install brake hose mounting screw and torque to 12 foot-pounds.

3. Pass forward end of hose through mounting hole in frame or bracket allowing hose to seek its own position. Insert barrel end of hose fitting into barrel hole in mounting bracket and install retainer.

4. Remove line caps and tighten pipe nuts to 20 foot-pounds maximum torque.

5. Bleed brakes as described in Note 6.

e. Removal—Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at brake hose on axle housing.

3. Unbend the welded retainer(s) on axle housing, and remove piping.

4. Remove screw securing pipe cleat to upper control arm bracket (R.H. only), remove piping.

f. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Install steel piping on welded retainers.

2. Connect piping at brake hose and tighten to 20 foot-pounds maximum torque.

3. Connect piping at wheel cylinder fitting, tightening to 20 foot-pounds maximum torque.

4. Bend welded retainer(s) over piping enough to secure, being careful not to damage brake piping.

5. Install screw and pipe cleat securing piping to R.H. upper control arm bracket.

6. Bleed all brakes as outlined in Note 6.

25. Hydraulic Brake Tubing

Hydraulic brake tubing is a double layer annealed steel terne plate tubing which resists corrosion and has the physical strength to stand up under the high pressures which are developed when applying the brakes. In making up hydraulic brake pipes, it is recommended that Flaring Tool No. J-23530 be used to double-lap flare the ends of the tubing. Unless the tubing is properly flared, the connections may leak and the brakes could become ineffective.

CAUTION: When necessary to replace brake tubing, always use special steel tubing which is designed to withstand high pressure and resist corrosion. Ordinary copper tubing is not satisfactory and should not be used.

This safety steel tubing must be double-lap flared at the ends in order to produce a strong leak-proof joint.

Figure 5-28 shows two pieces of tubing, one with single-lap flare "A" and the other with double-lap flare "B". It will be noted that the single-lap flare in "A" split the tubing while the one shown in "B" is well-formed and unbroken due to the reinforcement of the double wall.

The following procedure should be followed in making up hydraulic brake pipes.

26. Double Lap Flaring

1. Cut the tubing to the desired length.

2. Cut end square and clean burrs from inside and outside of tubing to be flared.

3. Using Tool No. J-23530, unscrew compression screw until swivel cone is at its highest point; swing strap to one side.

4. Open lever handle so it is at right angle to rest of tool, and revolve hexagonal tube clamps to accommodate tubing. (Selection of six sizes).

5. Be sure tubing nut is properly placed on tubing.

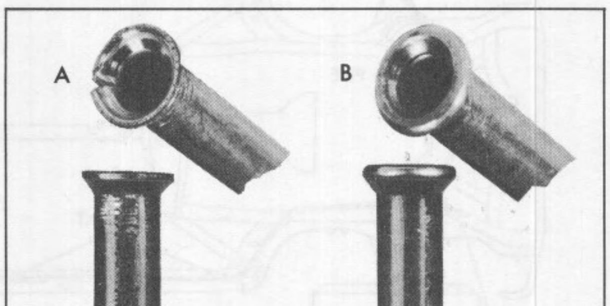


Fig. 5-28 Single and Double Lap Flair

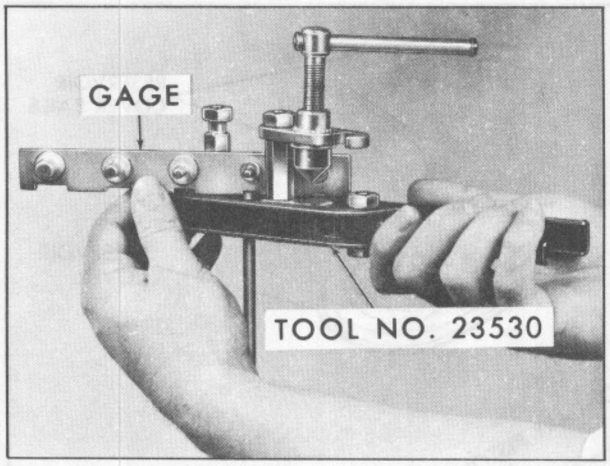


Fig. 5-29 Placing Tubing in Tool

Insert end of tube between two blocks until level with top of gage, Fig. 5-29.

6. Insert proper pin of gage into tubing and swing strap back in closed position. Tighten compression screw until gage bottoms on tool, Fig. 5-30, then unscrew compression screw and swing strap to one side. Remove gage.

7. Swing strap back in closed position, then tighten compression screw to flare cone downward to complete double-lap flare, Fig. 5-31.

8. Unscrew compression screw and open smaller lever handle to remove tubing.

9. Inspect flared ends for splits, cracks, pits or excessive out of round which may cause leaks.

10. Blow tubing out with dry compressed air to remove any foreign objects.

27. Power Brake Unit

a. Removal

1. Disconnect hydraulic brake lines from master cylinder, Fig. 5-32. Cap line fittings to prevent dirt from entering brake lines.

2. Disconnect vacuum hose from vacuum check valve on power head.

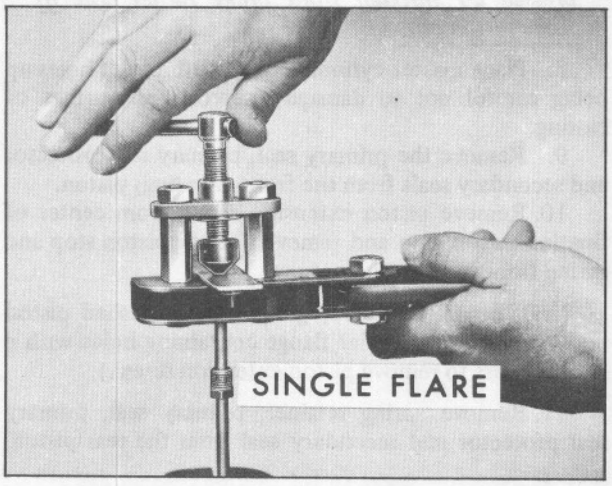


Fig. 5-30 Preparing for Double Lap

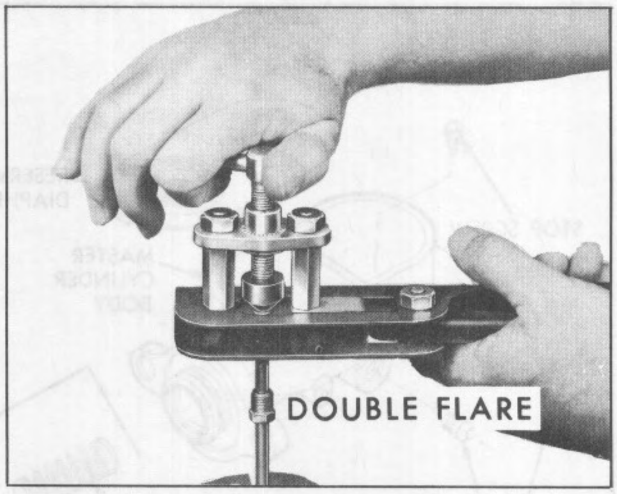


Fig. 5-31 Completing Double Lap Flair

3. Remove steering column lower cover as described in Section 12, Note 41a.

4. Remove retainer and washer that attach power unit push rod to brake pedal arm.

5. Remove any three of four nuts securing power unit to cowl and loosen fourth nut.

6. Working in engine compartment, free power unit from cowl.

7. Disconnect brake unit push rod from brake pedal arm. Remove spring spacer from brake pedal arm.

8. Remove remaining nut retaining power unit to cowl, and remove power unit gaskets and spacer from engine compartment.

b. Installation

1. Position power unit gaskets and spacer to cowl.

2. Working inside passenger compartment, loosely install four nuts retaining power unit to cowl.

3. Install spring spacer, push rod and washer on brake pedal arm and secure with retainer.

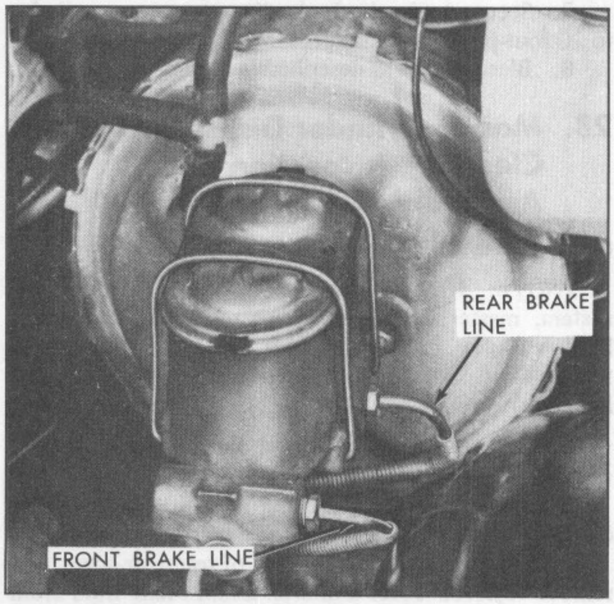


Fig. 5-32 Power Brake Unit

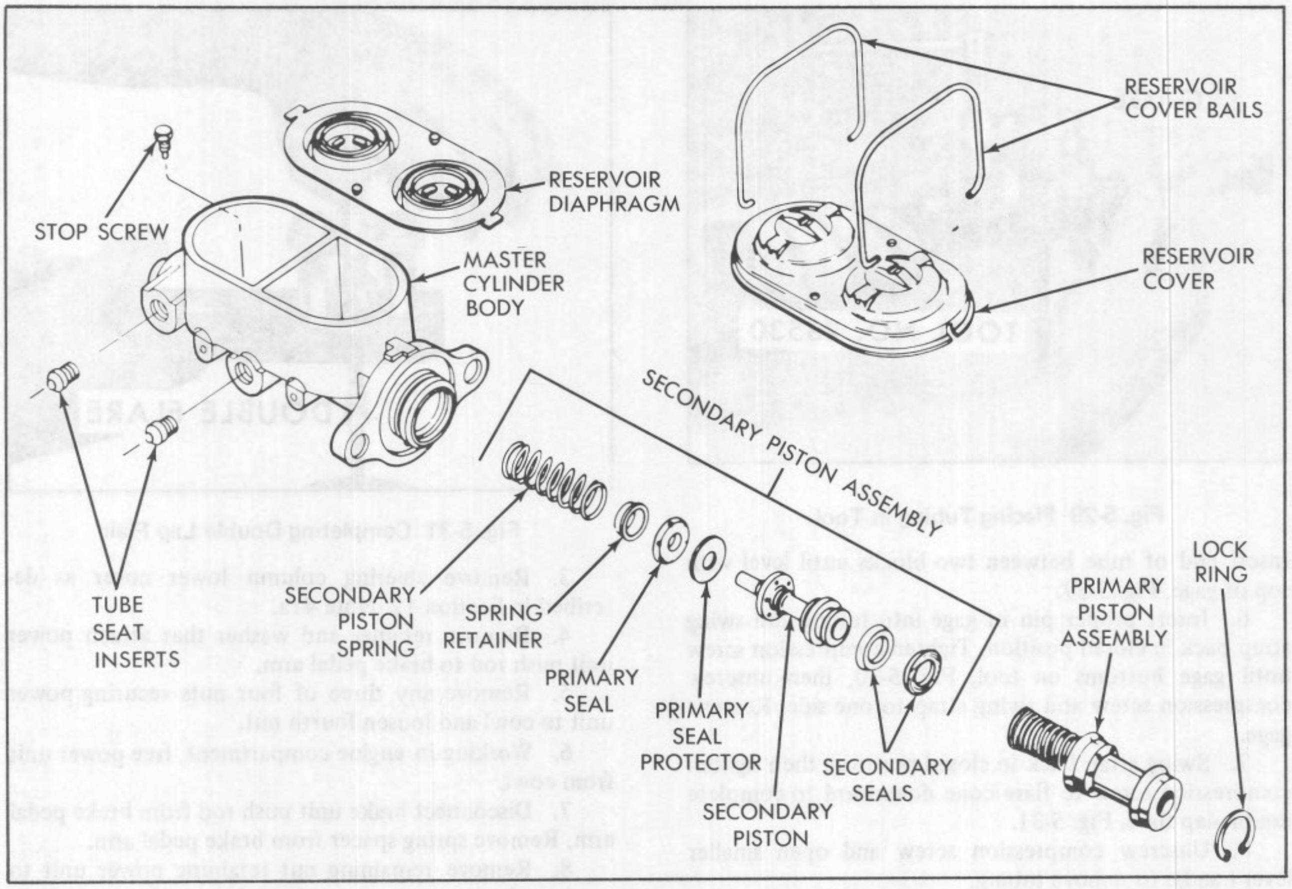


Fig. 5-33 Master Cylinder Disassembled

4. Tighten four nuts that hold the power unit to 16 foot-pounds.

See CAUTION page 5-8 prior to Note 6.

5. Install steering column lower cover as described in Section 12, Note 41b.

6. Connect vacuum hose to check valve on power unit.

7. Secure hydraulic brake lines to master cylinder to 20 foot-pounds maximum.

8. Bleed brakes as described in Note 6.

28. Master Cylinder Disassembly, Cleaning, Inspection and Assembly (Fig. 5-33)

a. Disassembly

(NOTE: If trouble has been traced to hydraulic system, master cylinder may be removed from power head without removing power head from car. Area surrounding master cylinder mounting surface must be kept clean.)

1. Disconnect and cap front and rear brake lines if not done previously.

2. Remove two self-locking nuts that hold master cylinder to power head and remove master cylinder.

3. Pry bale type retainers off of reservoir cover, and remove reservoir cover and seal. Drain brake fluid from reservoirs.

4. Remove seal from reservoir cover.

5. Remove floating piston stop bolt from front fluid reservoir.

6. Remove lock ring from open end of master cylinder and remove rear piston assembly, Fig. 5-33.

7. Firmly rap master cylinder on a block of wood until floating piston drops in bore and remove front (floating) piston assembly, retainer and spring.

CAUTION: Check progress of floating piston dropping in bore to avoid striking piston on wood. If floating piston sticks in bore, blow dry compressed air through front brake outlet hole to force piston out.

8. Place master cylinder in vise with outlet holes up being careful not to damage reservoir seal surface of casting.

9. Remove the primary seal, primary seal protector and secondary seals from the front (floating) piston.

10. Remove piston extension screw from center of floating piston stop and remove floating piston stop and spring from rear piston.

(NOTE: If necessary, grasp the unfinished piston body immediately under flange containing holes with a pair of pliers to remove piston extension screw.)

11. Remove spring retainer, primary seal, primary seal protector and secondary seal from the rear piston.

b. Cleaning and Inspection

1. Inspect master cylinder bore for scoring, pitting

or etching. Any of these will require replacement of master cylinder casting.

2. Examine fluid reservoir for foreign matter, and check all passages for restrictions. If there is any suspicion of contamination or evidence of corrosion, completely flush hydraulic system, using clean brake fluid.

(NOTE: A grease like silicone substance may be found inside the brake master cylinder when it is being overhauled. This substance is used by the manufacturer as a lubricant to provide smooth brake actuation. It is a normal condition and need not be cleaned out of the master cylinder before reassembly.)

3. Inspect floating piston for severe scoring, pitting, or distortion. Any of these will require replacement of master cylinder assembly.

4. Thoroughly wash all parts (except the inside of master cylinder) in clean alcohol, including new parts to be used in assembly of master cylinder but do not wash silicone out of master cylinder.

CAUTION: Use of gasoline, kerosene, or any cleaner with even a trace of mineral oil can damage rubber parts.

5. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

6. When overhauling a master cylinder, use all parts furnished in master cylinder repair kit.

c. Assembly

Be sure all parts are clean before assembling master cylinder. Do not let grease or mineral oil come in contact with any rubber parts.

1. Lubricate rubber parts with clean brake fluid.

2. Install new secondary seal in center groove of floating piston. Lip of seal should face compensating holes in opposite end of piston.

3. Install new secondary seal in groove at end of floating piston, back-to-back with secondary seal in center groove, Fig. 5-33 so that lip faces toward that end.

4. Install primary seal protector and primary seal over end of floating piston opposite secondary seals. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

5. Install secondary seal in groove on push rod end of rear piston. Lip of seal should face toward compensating holes in opposite end of piston.

6. Install primary seal protector and primary seal on opposite end of rear piston. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

7. Position spring retainer on one end of rear piston spring and floating piston stop on other end.

8. Position spring assembly on rear piston with spring retainer seated inside lips of primary seal.

9. Insert piston extension screw in center of floating piston stop.

10. Compress primary piston spring and start piston extension screw in hole in end of piston, release spring and turn down screw. Torque to 7-8 foot-pounds to bottom shoulder on screw against retainer.

11. Position retainer in floating piston spring and position spring assembly on floating piston with retainer seat inside lip of primary seal.

12. Coat master cylinder bore, primary seal and secondary seals on floating pistion with clean brake fluid.

13. Position master cylinder casting in vise so that open end of bore is down slightly and install floating piston assembly in bore, spring end first, until assembly bottoms in bore.

14. Reposition master cylinder in vise so that open end of bore is up.

15. Coat primary and secondary seals on rear piston assembly with clean brake fluid and insert assembly into master cylinder bore, spring end first.

16. Pressing downward on rear piston, install lock ring in groove in master cylinder piston.

17. Install floating piston stop bolt in front fluid reservoir, tightening to 3 foot-pounds maximum torque.

18. Install new reservoir seal on reservoir cover, place cover on master cylinder, retaining with bale-type retainers.

19. Install master cylinder on power head, torquing nuts to 20 foot-pounds maximum torque.

20. Install front and rear brake lines, if power head is on car, tightening lines to 15 foot-pounds and bleed brakes as described in Note 6.

29. Power Head Disassembly, Cleaning, Inspection and Assembly

a. Disassembly

(NOTE: Scribe mark on top center of front and rear housings in line with master cylinder reservoir cover to facilitate reassembly.)

1. Remove master cylinder reservoir cover retainers, reservoir cover and diaphragm, and empty brake fluid from reservoirs.

2. Remove two locknuts which hold master cylinder to front housing, and remove master cylinder from its mounting studs. Remove front housing seal from front shell.

(NOTE: If Separating Fixture, J-22884, is not available, use Separator, J-9504. Do not remove master cylinder at this time if J-9504 is to be used.)

3. Secure Power Unit Shell Holding and Separating Fixture, J-22884, and power head, Fig. 5-34. Studs on rear shell engage base of fixture and studs on front shell engage bar of tool with bar bearing against front shell. Secure front shell to bar with two master cylinder lock nuts.

4. Rotate bar counterclockwise and unlock shells.

5. Back off on hold down clamp sufficiently to

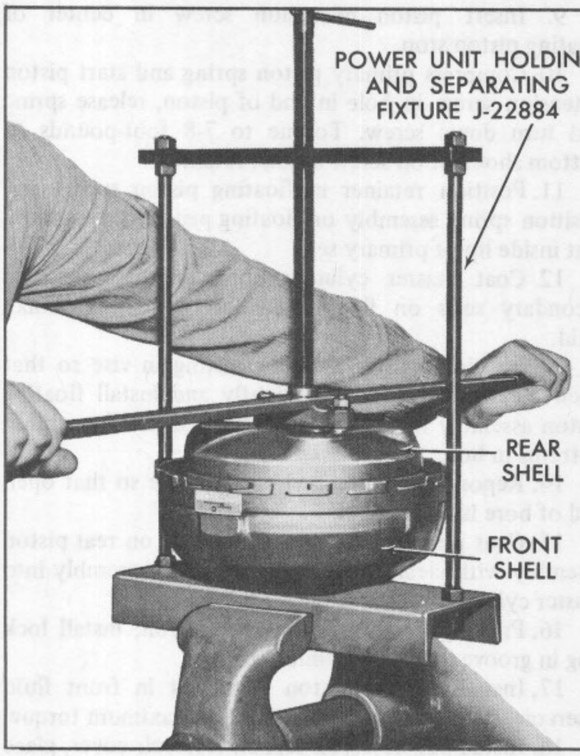


Fig. 5-34 Removing Rear Shell

remove front shell, return spring, retaining plate and piston rod retainer, Fig. 5-35 and 5-36.

WARNING: BE CAREFUL WHEN SEPARATING DIAPHRAGMS THAT RETURN SPRING DOES NOT FLY OUT AS INJURY MAY OCCUR.

6. Remove vacuum check valve and grommet from front shell.

7. Remove assembly from holding fixture and remove J-22884 from vise.

8. Remove dust boot retainer and boot from rear housing and push rod. Remove felt silencer from inside the boot.

9. Remove power piston assembly from rear shell and remove primary power piston seal from center opening of rear shell.

10. Lift bead on outside diameter of secondary diaphragm and remove diaphragm support ring, Fig. 5-36.

11. Mount Holding Fixture, J-23101, in a vise with wide jaws up. Position secondary power piston so that two radial slots in piston fit over jaws of tool, Fig. 5-37.

12. Fold back primary diaphragm from outside diameter of primary support plate. Grip edge of support plate and rotate counterclockwise to unscrew primary piston from secondary power piston, Fig. 5-38.

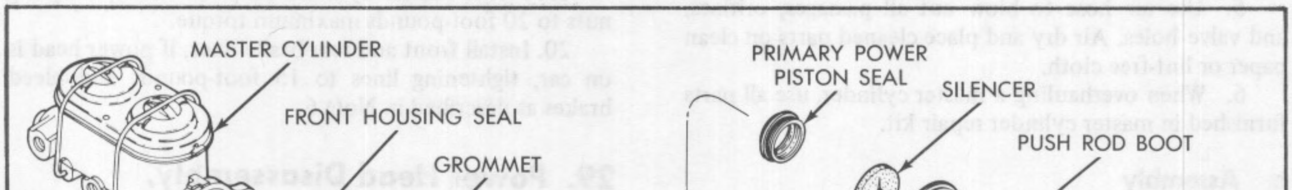


Fig 5-35 Power Head Disassembled

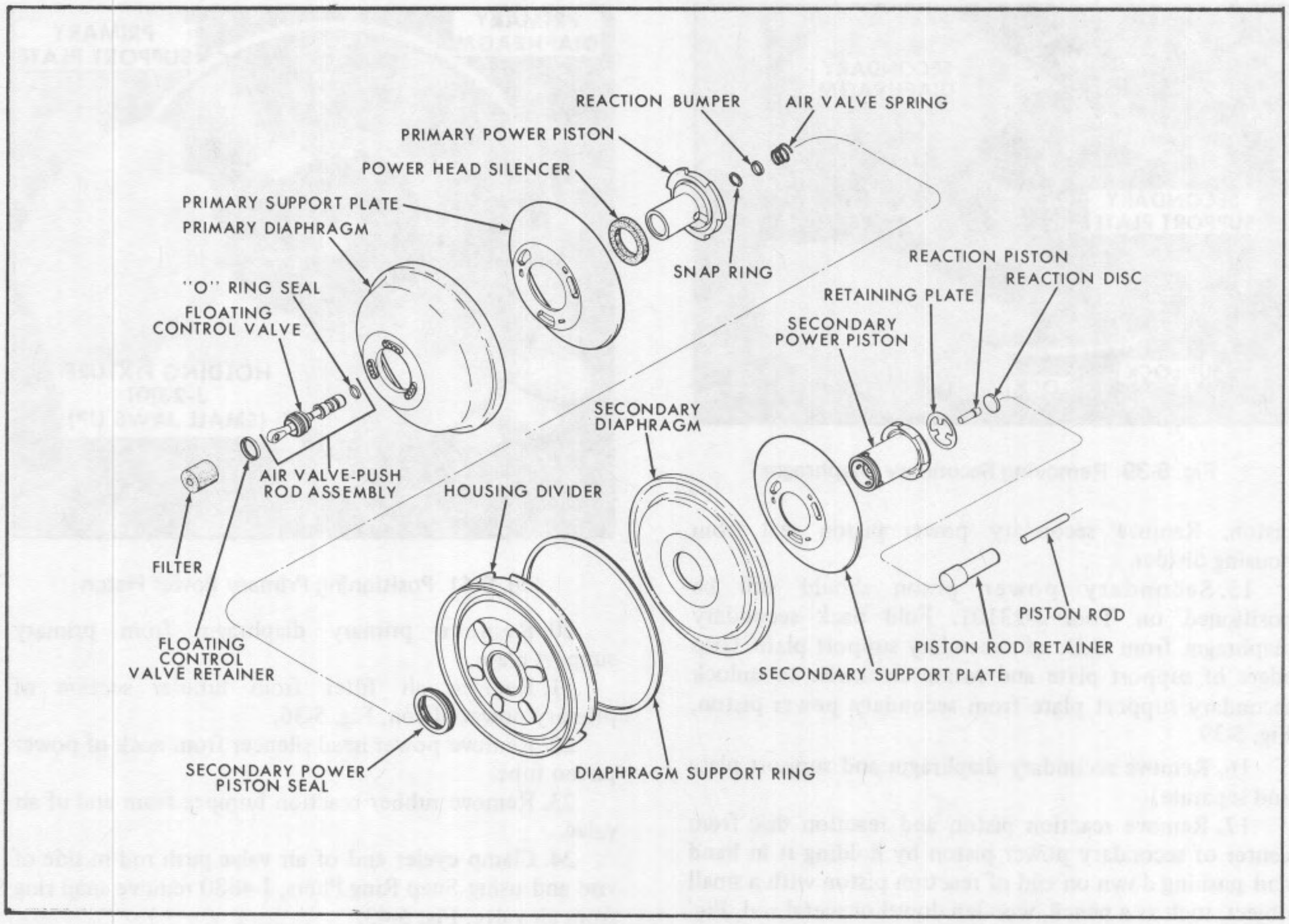


Fig. 5-36 Power Piston Disassembled

(NOTE: It is possible that primary support plate will unlock from primary piston before primary piston unscrews from secondary piston. If this happens, continue to turn primary support plate counterclockwise. Tabs ("stops") on primary support plate will temporarily lock primary support plate to primary power piston and permit continued counterclockwise rotation to unscrew primary power piston from secondary power piston.)

13. Remove air valve spring from secondary power piston or end of air valve.

14. Remove housing divider from secondary power

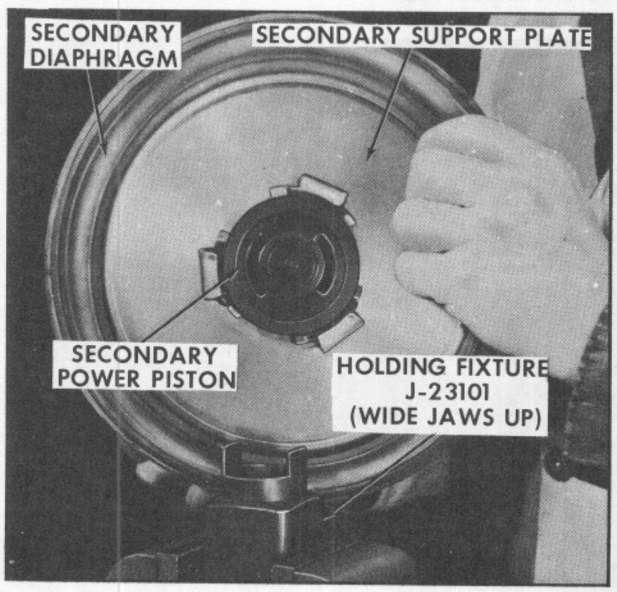


Fig. 5-37 Positioning Secondary Power Piston

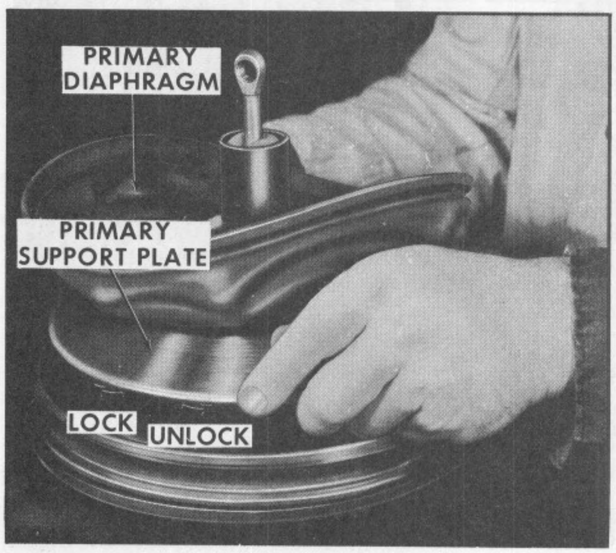


Fig. 5-38 Loosening Power Pistons

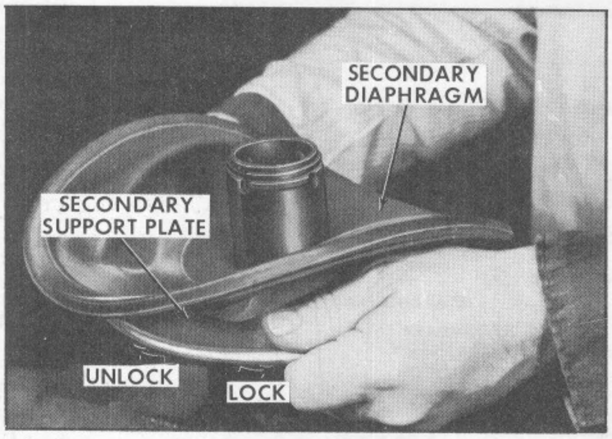


Fig. 5-39 Removing Secondary Diaphragm

piston. Remove secondary power piston seal from housing divider.

15. Secondary power piston should still be positioned on Tool J-23101. Fold back secondary diaphragm from O.D. of secondary support plate. Grip edges of support plate and rotate clockwise to unlock secondary support plate from secondary power piston, Fig. 5-39.

16. Remove secondary diaphragm and support plate and separate.

17. Remove reaction piston and reaction disc from center of secondary power piston by holding it in hand and pushing down on end of reaction piston with a small object, such as a pencil, wooden dowel or metal rod, Fig. 5-40.

18. Mount Tool J-23101 in vise with small jaws up. Position primary power piston so two radial slots in piston fit over jaws of tool, Fig. 5-41.

19. Fold back primary diaphragm from support plate. Grip edge of support plate and rotate in a counterclockwise direction to unlock primary support plate from primary power piston, Fig. 5-42.

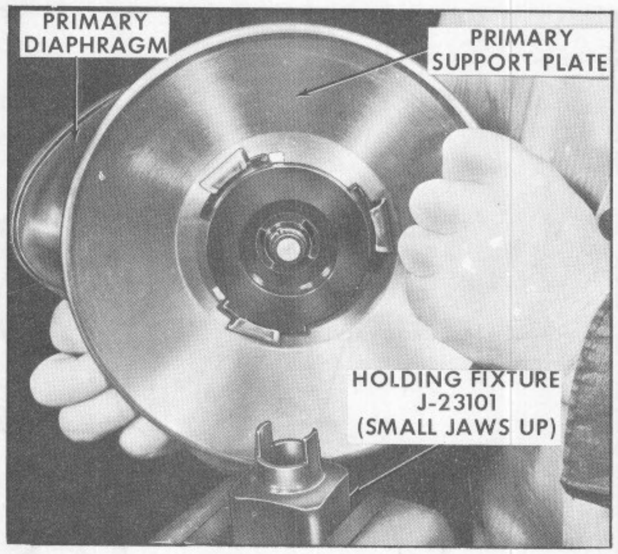


Fig. 5-41 Positioning Primary Power Piston

20. Remove primary diaphragm from primary support plate.

21. Remove air filter from tubular section of primary power piston, Fig. 5-36.

22. Remove power head silencer from neck of power piston tube.

23. Remove rubber reaction bumper from end of air valve.

24. Clamp eyelet end of air valve push rod in side of vise and using Snap Ring Pliers, J-4880 remove snap ring from air valve, Fig. 5-43.

25. Remove air valve-push rod assembly from tube end of primary power piston by pulling on primary power piston. A considerable force will be required.

Removal of air valve push rod assembly will disassemble control valve retainer.

26. Remove "O" ring seal from air valve.

Air valve push rod assembly is serviced as a complete assembly, since floating control valve cannot be removed over end of push rod.

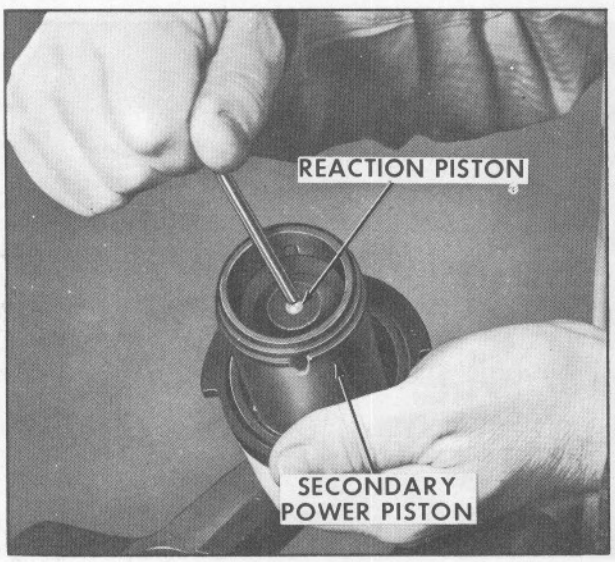


Fig. 5-40 Removing Reaction Piston

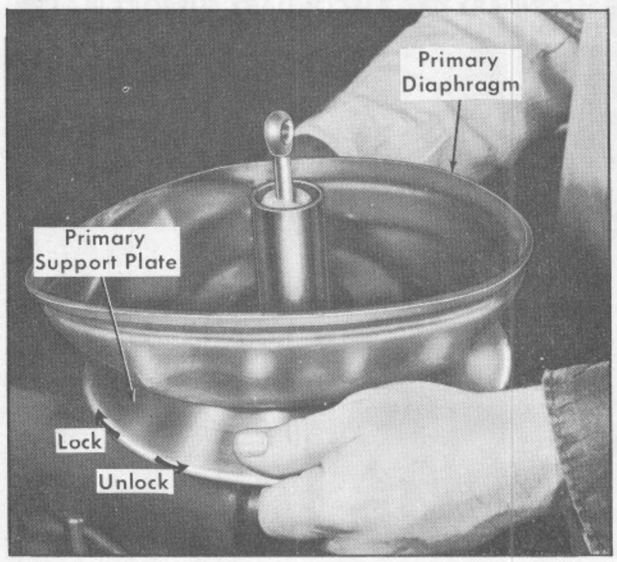


Fig. 5-42 Removing Primary Diaphragm

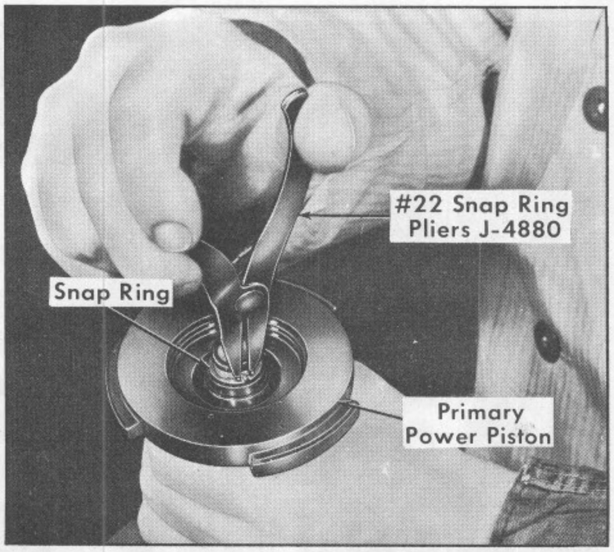


Fig. 5-43 Removing Snap Ring From Air Valve

b. Cleaning and Inspection

1. Thoroughly wash all parts in clean alcohol.

CAUTION: Use of gasoline, kerosene, or any cleaner with even a trace of mineral oil can damage rubber parts.

2. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.
3. If any rust is found inside front or rear shell, polish clean with crocus cloth or fine emery paper, washing clean afterwards.
4. Inspect front and rear shells for scratches, scores, pits, dents or other damage affecting rolling or sealing of diaphragm or other seals. Small imperfections may be smoothed out with fine crocus cloth.
5. Inspect all original parts, not being replaced by repair kit, for damage, distortion or excessive wear and chips, and replace as necessary.
6. Use all parts furnished in power head repair kit.

c. Assembly

1. Lubricate "O" ring seal, Fig. 5-36 with silicone lubricant and place on air valve.
2. Wipe a thin film of silicone lubricant on large and small O.D. of floating control valve.
3. If floating control valve needs replacement, it will be necessary to replace complete air valve push rod assembly, since floating control valve is a component part of this assembly and cannot be disassembled from push rod, Fig. 5-44.
4. Place air valve end of air valve push rod assembly into tube of primary power piston. Manually press air valve push rod assembly so that floating control valve bottoms on tube section of primary power piston.
5. Place floating control valve retainer (Fig. 5-43) on Control Valve Retainer Installer, J-23175. Place over push rod so that closed side of retainer seats on floating control valve. With Installer, J-23175, manually press retainer and floating control valve assembly to seat in primary power piston tube, Fig. 5-45.

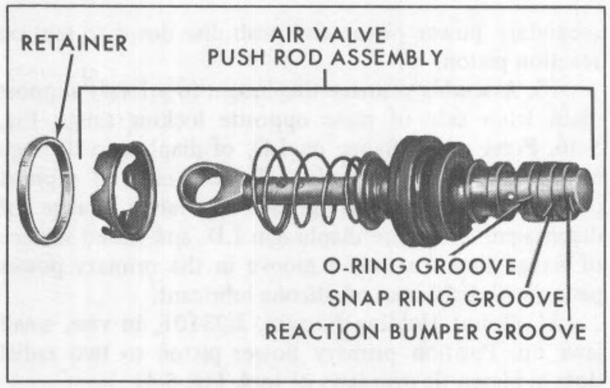


Fig. 5-44 Floating Control Valve

6. The filter element can now be stretched over push rod eye and pressed into primary power piston tube, Fig. 5-36.
7. Using Snap Ring Pliers, J-4880, place snap ring in its air valve groove, Fig. 5-43.

(NOTE: If snap ring is installed in O-ring groove, power pistons will not thread together all the way and threads may be damaged.)

8. Position rubber reaction bumper on end of air valve.
9. Apply a light film of silicone lubricant to O.D. of rubber reaction disc. Place disc in small cavity of the

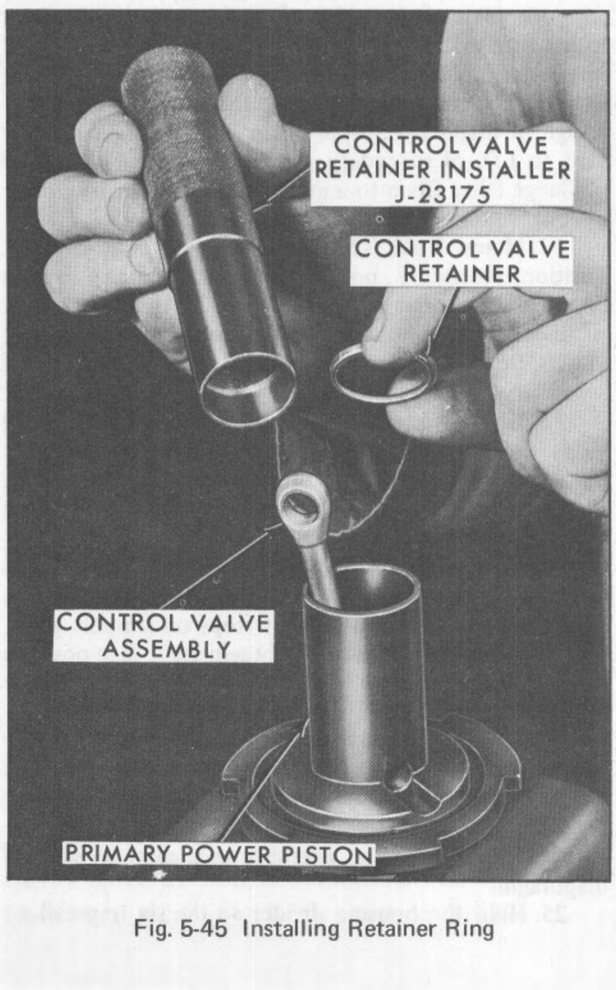


Fig. 5-45 Installing Retainer Ring

secondary power piston and push disc down to seat on reaction piston.

10. Assemble primary diaphragm to primary support plate from side of plate opposite locking tangs, Fig. 5-36. Press raised flange on I.D. of diaphragm through center hole of support plate. Be sure edge of support plate center hole fits groove in raised flange of diaphragm. Lubricate diaphragm I.D. and raised surface of flange that fits into a groove in the primary power piston with light coat of silicone lubricant.

11. Mount Holding Fixture, J-23101, in vise, small jaws up. Position primary power piston so two radial slots in piston fit over jaws of tool, Fig. 5-41.

12. Fold primary diaphragm away from O.D. of the primary support plate.

13. Holding edges of the support plate, with the locking tangs down, place primary support plate and diaphragm assembly over tube of primary power piston. Flange on the I.D. of primary diaphragm will fit groove in the primary power piston.

14. Grip edges of primary support plate, press down, and rotate clockwise until tabs on primary power piston contact stops on support plate, Fig. 5-42.

15. Place power head silencer on tube of primary power piston so holes at the base of tube are covered.

16. Apply a very light film of silicone lubricant to O.D. of primary power piston tube.

17. Remove primary piston assembly from Tool J-23101 and lay it aside.

18. Assemble secondary diaphragm to secondary support plate from side of support plate opposite locking tangs, Fig. 5-36. Press raised flange on I.D. of diaphragm through center hole of support plate. Be sure edge of support plate center hole fits groove in the raised flange of diaphragm. Apply thin coat of silicone lubricant to I.D. of secondary diaphragm and raised surface of flange (that fits into a groove in the secondary power piston).

19. Mount Tool J-23101 in vise with large jaws up. Position secondary power piston so curved slots in piston fit over jaws of tool, Fig. 5-37. Apply light coat of silicone lubricant to tube of secondary power piston.

20. Fold secondary diaphragm away from O.D. of secondary support plate.

21. Holding edges of the support plate, with locking tangs down, place secondary diaphragm and support plate assembly over tube of secondary power piston. Flange on I.D. of secondary diaphragm will fit secondary piston groove.

22. Grip edges of secondary support plate, press down, and rotate counterclockwise until tabs on secondary power piston contact stops on support plate, Fig. 5-38. Fold secondary diaphragm back into position on secondary support plate. Leave secondary power piston assembly on Tool J-23101 in vise.

23. Apply light coat of talcum powder or silicone lubricant to bead on O.D. of secondary diaphragm. This will facilitate assembly of front and rear housings.

24. Place secondary diaphragm support ring on the secondary power piston assembly so it rests on edge of diaphragm.

25. Hold the housing divider so the six impressions on middle of divider stick up. Install seal so part number can be read from this side.

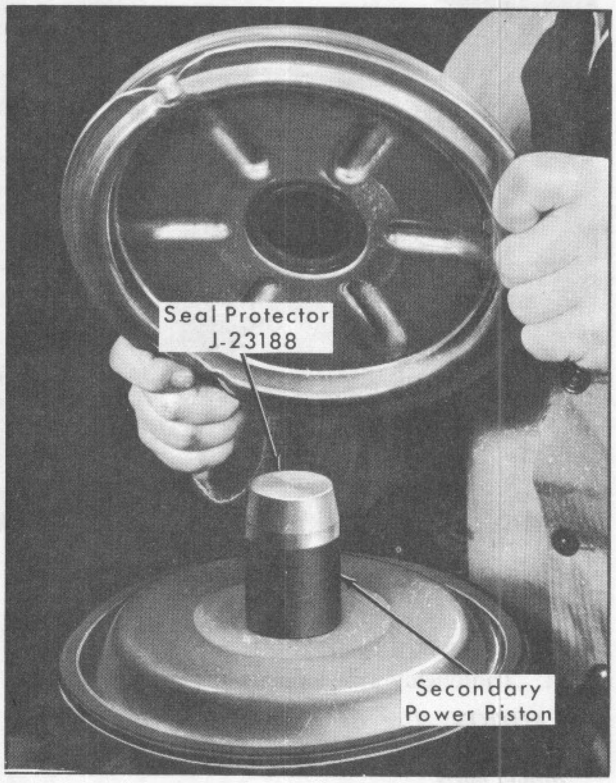


Fig. 5-46 Installing Housing Divider

26. Lubricate I.D. of secondary seal with silicone lubricant.

27. Position Secondary Seal Protector Tool, J-23188 on threaded end of secondary power piston, Fig. 5-46.

28. Hold the housing divider so the six impressions on middle of divider stick up. Press divider down over tool and onto secondary power piston tube where it will rest against the diaphragm support ring. Remove Seal Protector, J-23188, from secondary power piston; however, do not remove secondary power piston subassembly from Holding Fixture, J-23101.

29. Pick up primary power piston assembly and position small end of air valve return spring on air valve so it contacts air valve retaining ring.

30. Fold primary diaphragm away from O.D. of primary support plate.

31. Position primary power piston on tubular portion of secondary power piston, making sure small end of air valve return spring seats on air valve snap ring.

32. Grip edge of primary support plate, press down, and start threads on secondary power piston into threaded portion of primary power piston by rotating clockwise, Fig. 5-38.

33. Continue to tighten primary power piston until it is securely attached to secondary power piston.

34. Fold primary diaphragm back into position on primary support plate and pull diaphragm O.D. over formed lip of housing divider. Check to be sure bead on diaphragm is seated evenly around complete circumference.

35. Remove assembly from tool J-23101. Wipe a thin film of silicone lubricant on O.D. of piston rod retainer. Insert master cylinder piston rod retainer into secondary power piston cavity so flat end bottoms against rubber reaction disc in bottom of cavity.

36. Place primary power piston seal in rear housing center hold so formed flange of housing center hole fits groove of primary power piston seal. The part number of seal should show on inside of shell.

37. Coat I.D. of primary power piston seal with thin film of silicone lubricant.

38. Mount Power Unit Holding and Separating Fixture, J-22884, in vise and position rear shell on tool so studs fit holes provided in tool.

39. Position power piston return spring over front shell.

40. Assemble power piston to rear shell by pressing primary power piston tube through rear housing seal. Press down until housing divider seats in the rear shell and primary power piston bottoms against shell.

41. Place piston rod retaining plate on end of power piston.

42. Install vacuum check valve grommet in front shell with large diameter outside.

43. Install vacuum check valve.

44. Hold front shell assembly (with mounting studs up) over rear shell. Position front shell so that when tangs on edge of front shell are locked in slots on edge of rear shell, scribe marks on top of shells will be in line.

45. Lower front shell assembly onto rear shell by tightening hold down clamp. Check to be sure piston rod retainer goes through center of retaining plate on power piston return spring. Retaining plate and power piston spring must seat in depression in face of secondary power piston. Check to be sure bead on O.D. of secondary diaphragm is positioned between edges of shells.

46. Continue to tighten clamp on front shell and fit tangs, in appropriate slots, on rear shell.

47. Rotate bar clockwise into locked position and remove power head from Holding Fixture, J-22884.

48. Place silencer in closed end of power head boot. Stretch boot over push rod and over flange in center of rear housing and install boot retainer.

49. Place power head assembly in vise with front shell facing up. Insert master cylinder piston rod, flat end first, into piston rod retainer.

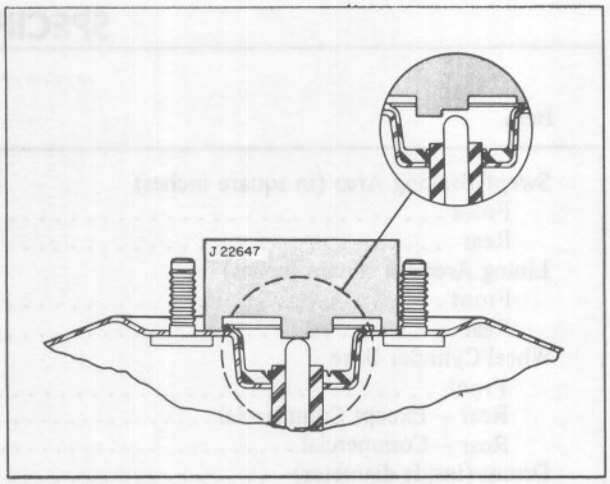


Fig. 5-47 Gaging Push Rod

50. Press down on master cylinder piston rod to be sure it is properly seated.

(NOTE: Remove front housing seal to assure that no vacuum is in power head while gaging.)

51. Place Gage, J-22647, over piston rod in a position which will allow gage to be slipped to left or right without contacting studs. (Fig. 5-47)

The center section of gage has two levels. The piston rod should always contact the long section (low level) of gage. The piston rod should never contact the short section (high level) of gage, Fig. 5-47. Move gage from side to side to check piston rod height.

Any variation beyond these two limits must be compensated for by obtaining an adjustable piston rod from your servicing Parts Distribution Center and adjusting self-locking screw to meet gaging specifications.

52. Wipe a thin film of silicone lubricant on the I.D. of front housing seal and position seal in housing depression.

53. Install master cylinder assembly on front housing, positioning cylinder on mounting studs so top of master cylinder reservoir is toward scribe marks on housing. Assemble locknuts on studs and torque to 20 foot-pounds.

SPECIFICATIONS

Item	All Series Except Eldorado
Swept Braking Area (in square inches)	
Front	241
Rear	189
Lining Area (in square inches)	
Front	42
Rear	117
Wheel Cylinder Bore	
Front	2-15/16"
Rear – Except Commercial	15/16"
Rear – Commercial	1"
Drums (inside diameter)	12.00"
Remachined Drum Diameter (maximum)	12.060"
Worn Drum Diameter (maximum)	12.090"
Variations of Inside Drum Diameter (maximum)	.0015"
Run-Out of Inside Drum Diameter (maximum)	.005"
Disc Thickness – minimum – Refinished	1.220"
– minimum – Worn	1.215"
Clearance Between Secondary Linings and Drums	.010" – .030"
Lateral Run-Out of Disc	.005"
Flatness and Parallelism Between Frictional Surfaces of Disc	.0005"
Lining Size (length, width, thickness in inches)	
Front — Inner Shoe	5.4 x 1.93 x .43
Front — Outer Shoe	5.4 x 1.93 x 41
Rear Primary	11.00 x 2.50 x .24
Rear Secondary	12.36 x 2.50 x 26
Lining to Shoe Attachment Method Rear	Rivets
Front	Brass Eyelet
Brake Combination Valve	
Front Brake Cut-in Pressure	130 psi
Front Brake Blend Pressure	650 psi
Rear Brake Proportioning Pressure – (except Limousine and Commercial and Track Master)	41% above 350 psi
Rear Brake Proportioning Pressure with Track Master (Except Limousine and Commercial)	41% above 470 psi
Failure Warning Differential Pressure	100-300 psi

TORQUE SPECIFICATIONS

Material Number	Application	Size	Foot-Pounds
Special	Pipe Nut to Master Cylinder	1/2 –20 or 9/16–18	25 Max.
Special	All Other Brake Pipe Nuts	3/8 –24, 7/16–24, 1/2 –20	20 Max.
260M	Parking Brake Cable Clamps (at Backing Plate)	5/16–24	11
Special	**Brake Hose to Caliper	7/16–20	30 Max.
300M	**Brake Backing Plate to Rear Axle Housing	7/16–20	40 Max.
284M	**Brake Unit to Cowl	3/8 –16	13
286M	Brake Pedal Pivot Bolt	7/16–20	13
286M	Master Cylinder to Vacuum Power Head	3/8 –24	20
Special	**Caliper to Steering Knuckle Bolt	Special	30
Special	Piston Extension Screw	Special	90*
Special	Floating Piston Stop Bolt	10–24	30*
	Wheel Mounting Nuts		130
			*Inch-Pounds
(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)			

***CAUTION: This fastener is is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

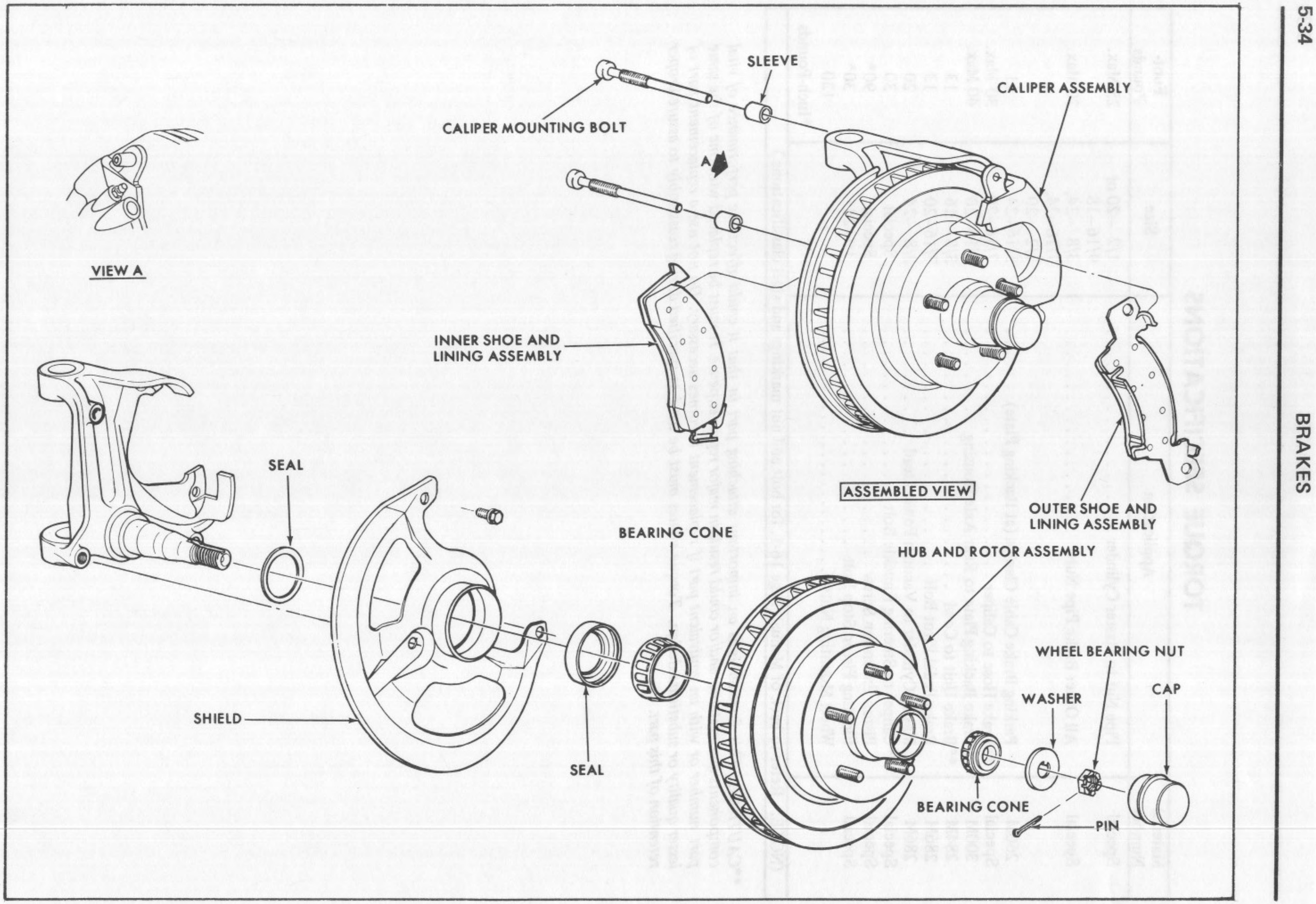


Fig. 5-48 Front Disc Brake

THEORY OF OPERATION

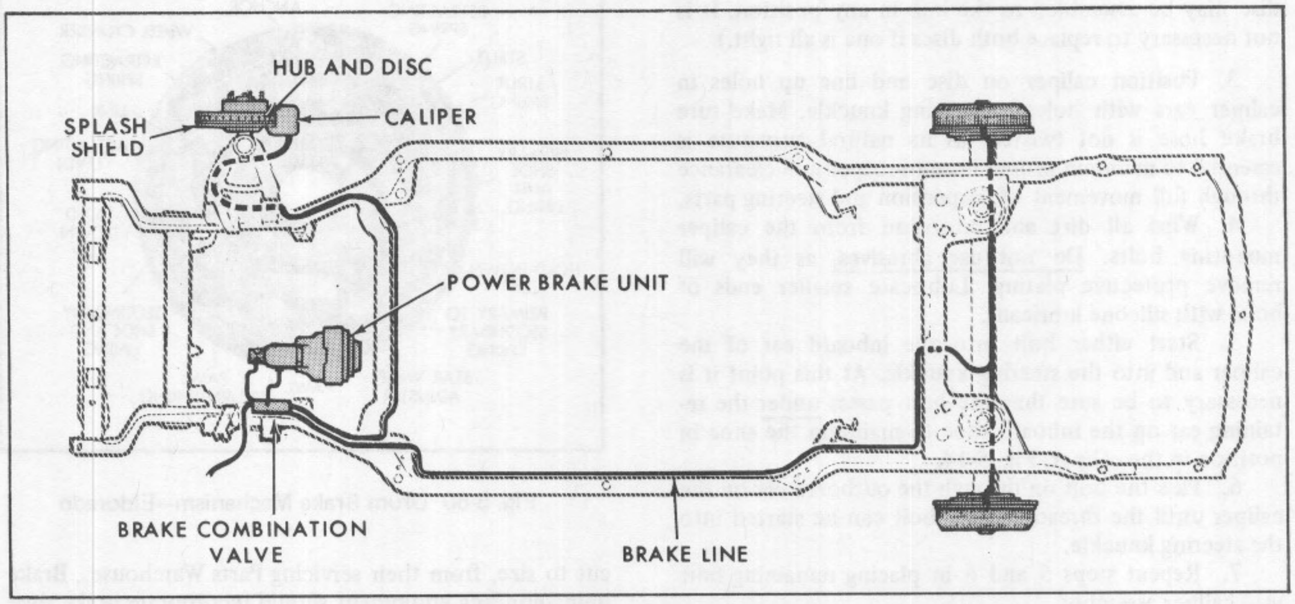


Fig. 5-49 Location of Components—Eldorado

(NOTE: The following information pertains only to the Eldorado, Fig. 5-49

Single Piston Sliding Caliper Front Disc Brakes

The single piston sliding caliper front disc brake used on the Eldorado is serviced in the same manner as those installed on other Cadillac cars. The following items are distinctive to the Eldorado.

Hub and Disc

The Eldorado disc is loose mounted or "floating" as opposed to an integral unit on other cars. The disc and hub are separate components so that disc replacement does not require replacing the hub and bearings. The disc is held in place by lug nuts and may be removed as easily as a brake drum once the caliper is removed. The disc is 11" in diameter on the Eldorado only.

Brake Combination Valve

The combination valve is mounted on a bracket to the rear of the left side upper shock absorber mounting bracket and is secured to the frame side rail by two tapping screws. The operation of the brake combination valve is the same as all other Cadillac models.

SERVICE INFORMATION

(NOTE: The service information that follows pertains only to the Eldorado. For service procedures not given, refer to the forward portion of this section, as these procedures are the same as for the other Cadillac models.)

30. Disc Assembly Removal and Installation

a. Removal

1. Raise car and remove front wheel.
2. Remove two bolts which hold caliper to steering knuckle.

(NOTE: It is not necessary to remove brake hose from caliper when removing disc for service.)

3. Remove cotter pin, loosen joint upper ball nut and slip brake hose collar out of its clip. The slack gained will permit removal of caliper without pulling hose.
4. Slide caliper off disc and support by a hook-shaped wire fastened to upper control arm.

CAUTION: Do not allow caliper to hang from brake hose as this could result in possible damage to hose.

5. Mark a wheel stud and a corresponding place on the disc to assist in installation.
6. Remove the disc by sliding it off the hub.

b. Installation

1. Inspect hub flange and disc mating surfaces to make sure that they are free of dirt and other foreign material. Clean as required.
2. If reinstalling original disc, align index marks on hub and disc and slide disc over hub pilot diameter, making sure that disc is seated against hub flange.

(NOTE: If disc replacement is necessary, the new disc may be assembled to the hub in any position. It is not necessary to replace both discs if one is all right.)

3. Position caliper on disc and line up holes in caliper ears with holes in steering knuckle. Make sure brake hose is not twisted, as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.

4. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate smaller ends of bolts with silicone lubricant.

5. Start either bolt into the inboard ear of the caliper and into the steering knuckle. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-14.

6. Pass the bolt on through the outboard ear on the caliper until the threads on the bolt can be started into the steering knuckle.

7. Repeat steps 5 and 6 in placing remaining bolt into caliper assembly.

See CAUTION page 5-8, prior to NOTE 6 for steps 8, 12, 13.

8. Tighten caliper mounting bolts to 30 foot-pounds.

9. Pump brake pedal to seat lining against rotors.

10. Clinch upper ears of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear, see Fig. 5-15.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

11. If radial clearance exists, repeat clinching procedure.

12. Center brake hose collar in clip and tighten ball joint nut to 60 foot-pounds. Install cotter pin.

13. Install wheels, tighten wheel mounting nuts to 130 foot-pounds and lower car.

14. Allow car weight to be supported on front wheels and inspect front brake hoses for twisted condition. If necessary, correct as described in Note 34b.

15. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

31. Relining Rear Drum Brakes (Fig. 5-50)

When brake relining is necessary, it is recommended that the complete brake lining and shoe assemblies be replaced with new assemblies. New lining and shoe assemblies are precision-ground to fit the drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings and drum. This simplifies the complete relining operation and insures a satisfactory job for the customer.

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Warehouses. Brake lining-grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

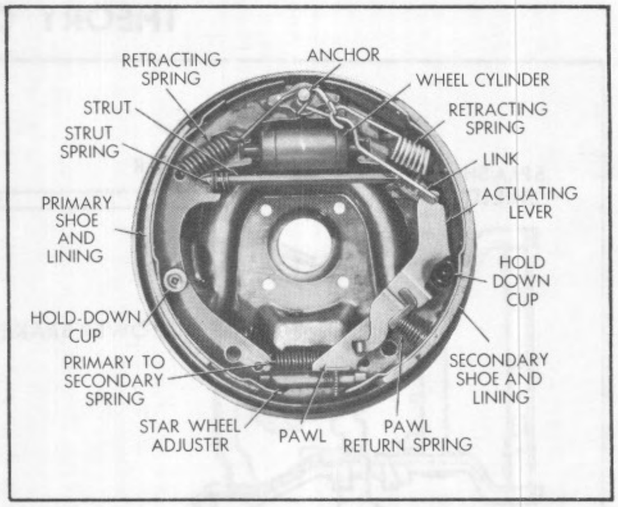


Fig. 5-50 Drum Brake Mechanism—Eldorado

1. Release parking brake, raise car, and remove rear wheels and drums. A clip nut on one wheel stud retains the drum to the hub during removal.

CAUTION: When handling brake drums, be extremely careful not to drop the drum or get brake fluid or grease on friction surface resulting in possible damage.

2. Loosen parking brake cable locknut at equalizer.

3. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.

4. Disconnect link at anchor, using Brake Spring Remover and Installer, J-8049, and remove link, secondary brake shoe retracting spring, and anchor plate.

5. Remove primary brake shoe hold-down cup, spring, washer and pin, secondary brake shoe hold-down cup, spring, pin and sleeve.

6. Remove pivot pawl and override spring as an assembly, and remove pawl return spring.

7. Spread brake shoes and remove parking brake strut rod and spring.

8. Remove parking brake operating lever from secondary brake shoe and remove shoe and lining assemblies from brake backing plate.

9. Remove star wheel adjuster and primary-to-secondary connecting spring from brake shoes.

10. Clean brake backing plate and all brake parts.

CAUTION: Make certain that hands are clean when handling brake parts. Avoid handling friction surfaces of drums and linings resulting in possible contamination.

11. Lubricate threads and socket of star wheel adjuster and points of contact between brake shoes and other brake parts with special heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

12. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

13. Install star wheel adjuster and primary-to-secondary connecting spring on replacement brake shoes.

CAUTION: Star wheel adjusters with three wide groove on O.D. of pivot nut (left hand thread) are installed on right side of car, while those with three narrow groove (right hand thread) on O.D. of pivot nut are installed on left side of car. Reverse order may result in loss of brakes.

14. Install parking brake operating lever on secondary brake shoe and position shoe and lining assemblies to brake backing plate.

15. Install parking brake strut rod and spring on brake shoes.

(NOTE: Spring is positioned against primary brake shoe web).

16. Engage brake shoes with wheel cylinder connecting links and install primary brake shoe hold-down pin, washer, spring (green) and cup.

17. Install anchor plate and position pivot and pawl as an assembly to secondary brake shoe.

18. Install link and pawl return spring and secure all parts to secondary brake shoe by installing hold-down sleeve.

19. Install secondary brake shoe hold-down pin, spring (maroon) and cup.

20. Install primary brake shoe retracting spring (grey) using Brake Spring Remover and Installer, J-8049.

21. Install secondary brake shoe retracting spring (blue) using Brake Spring Remover and Installer, J-8049.

22. Install rear brake drums and clip nut retaining drum to hub.

23. Perform manual service brake adjustment as described in Note 7.

24. Install rear wheels and lower car. Tighten wheel mounting nuts to 130 foot-pounds.

25. Adjust parking brake as described in Note 8.

(NOTE: Parking brake must be readjusted to prevent possible burn out of rear brakes.)

32. Parking Brake

a. Front Cable

The procedure for removing and installing the front parking brake cable is described in Note 22a and 22b respectively.

b. Removal–Center Cable

1. Release parking brake.
2. Remove equalizer nut and washer from cable stud and remove equalizer.
3. Remove cable from wire guide at center of torsion bar support.
4. Remove cable from hook at right side of underbody.
5. Remove cable from right and left connectors to rear cables.
6. Thread cable out of torsion bar support and through underbody bracket. Remove cable.

c. Installation–Center Cable

1. Thread cable through underbody bracket and torsion bar support.
2. Install cable in right and left connectors.
3. Install cable in hook at right side of underbody.
4. Install cable in wire guide at center of torsion bar support.
5. Install equalizer on cable stud and secure with washer and nut.
6. Adjust parking brake described in Note 8.

d. Removal–Rear Cable

1. Release parking brake.
2. Raise rear of car and position on jack stands.
3. Remove rear wheels and drums.
4. Loosen equalizer nut and washer.
5. Remove cable from connector.
6. Remove clips retaining parking brake cable to lower control arm brackets on right and left sides.
7. Remove cable ends from parking brake operating levers, and remove cable ends from backing plates.

e. Installation–Rear Cable

1. Install cable ends through backing plates and connect to parking brake operating levers.
2. Install pawl lever and pawl spring.

(NOTE: Pull on cable and check operation of cable and brake mechanisms.)

3. Position brake cable to lower control arm brackets on right and left sides of car, and secure with clip.
4. Install cable in connector.
5. Tighten equalizer nut and washer.
6. Install rear drums and wheels. Tighten wheel mounting nuts to 130 foot-pounds.
7. Adjust parking brake as described in Note 8.

33. Brake Combination Valve

a. Removal

1. Raise hood.
2. Disconnect wiring connector from valve.
3. Disconnect three brake pipes from top and one from front of valve and remaining brake pipe from bottom of valve.
4. Remove two bolts securing valve to frame bracket and remove valve.

b. Installation

1. Position valve to frame bracket and secure with two bolts.
2. Install brake pipe to bottom of valve and one brake pipe to front of valve and three on top.
3. Connect wiring connector to valve.

(NOTE: When replacing a combination valve, rear brake bleeding can be accomplished by allowing brake fluid to flow from the rear brake pipe nut at the valve.

Back off this nut one turn and catch fluid flow in a cloth or a container until air is eliminated.

The front brakes should be bled at the calipers in the usual manner. Then, before driving car, be sure a firm pedal is obtained.)

4. Bleed brakes as described in Note 6.
5. Close hood.

34. Servicing Hydraulic Brake Hoses and Piping

Hydraulic pressure is transferred to the wheel cylinders through steel brake piping, flexible hoses, and a brake combination valve.

The steel brake lines and flexible hoses should be inspected every spring and fall for damage that may occur from various road hazards.

While the flexible hoses and steel piping require no periodic servicing, it may be necessary to replace damaged hoses or piping in the following manner:

a. Removal—(Front Wheels)

1. Disconnect steel brake line from hose at frame bracket by turning steel tube fitting out of hose fitting. Cap fitting to prevent dirt from entering brake line.
2. Remove U-shaped retainer from hose fitting at frame support bracket and remove hose from bracket.
3. Remove cotter pin and nut securing upper ball joint to knuckle and remove clip securing brake hose to ball joint stud.
4. If right front hose is being replaced, remove clip retaining hose to frame.
5. Turn hose out of inlet fitting of caliper and remove and discard copper gasket. If hose is to be reused, cap end fittings to prevent dirt from entering hose.

b. Installation—(Front Wheels)

1. Install new copper gasket on caliper end of hose (male end).
2. Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in wheel cylinder inlet with hose attached at frame end, as this will twist the hose and may cause possible damage.

3. Install brake hose clip on upper ball joint stud and install ball joint retaining nut on stud. Tighten ball joint nut finger tight.

When assembling front brake hoses at the frame attachment bracket, front standing height must be set to 13.50 inches as measured along shock absorber from centerline of top mounting bolt to centerline of bottom mounting bolt. Before hose is assembled to bracket.

CAUTION: Hose must not be twisted when assembled as possible damage or interference may occur.

This measurement can be obtained by using Tool J-24842. Insert bottom of tool in lower control arm below shock mounting bracket. Compress suspension

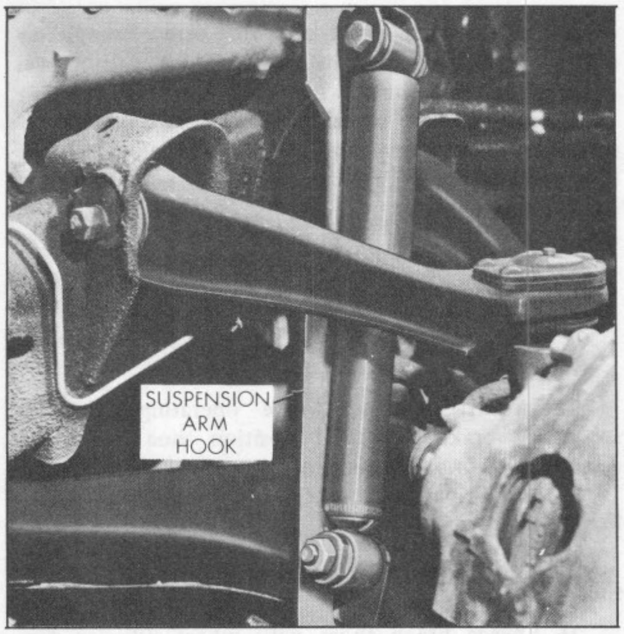


Fig. 5-51 Suspension Arm Hook Installed

and insert top of tool into upper shock mounting bracket, Fig. 5-51.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension, steering and driving parts.)

4. With suspension in position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in the position that will require the least twist in hose.
5. Install U-shaped retainer to secure hose to frame support bracket.
6. If right front hose is being replaced, install clip securing hose to frame.
7. Inspect by turning wheels from stop-to-stop while observing hose position. Be sure that hose does not touch any other part at any time during steering travel. If contact does occur, remove hose retainer, and if necessary loosen upper ball joint nut, and reposition hose as necessary. Replace retainer, tighten ball joint nut finger tight, and reinspect.
8. When hose is properly positioned, torque ball joint nut to 60 foot-pounds minimum.

See CAUTION page 5-8 prior to Note 6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: When installing cotter pin, make sure ends of pin are pinched tight against flat of nut. DO NOT let end of cotter pin extend down toward outer drive axle seal.

9. Install steel brake line fitting into brake hose at frame support bracket and tighten fitting to 20 foot-pounds maximum torque.
10. Bleed brakes as described in Note 6.

c. Removal–Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at brake line junction fitting on rear axle.

3. If left brake pipe is being removed, bend clip open and remove pipe.

4. If right brake piping is being removed, bend clips open and remove piping.

d. Installation–Hydraulic Brake Piping (Rear Wheels)

1. Position brake piping to rear axle and hand start tube nuts into wheel cylinder and junction block.

a. If right brake piping is being installed, bend clips over pipe, retaining piping to rear axle.

b. If left brake piping is being installed, bend clip retaining piping to rear axle.

2. Tighten piping to brake line junction fitting on rear axle, tighten to 20 foot-pounds maximum torque.

3. Tighten brake piping to rear wheel cylinder fitting, tighten to 20 foot-pounds maximum torque.

4. Bleed all brakes as described in Note 6.

e. Removal–Hydraulic Brake Hose (Rear Wheels)

1. Disconnect steel brake pipe from hose. Cap pipe.

2. Remove retainer securing forward end of brake hose to frame.

3. Remove bolt from junction block on axle.

4. Disconnect rear axle piping from junction block. Cap pipes.

f. Installation–Hydraulic Brake Hose (Rear Wheels)

1. Connect rear axle piping to junction block. Tighten fittings to 20 foot-pounds maximum torque.

2. Bolt junction block to axle.

3. Pass female end of hose through frame allowing hose to seek its own position.

4. Install retainer to secure hose to frame.

5. Place steel tube connector in hose fitting and tighten to 20 foot-pounds maximum torque.

CAUTION: Do not allow hose to twist out of its normal position as this may cause damage.

6. Bleed all brakes as described in Note 6.

TORQUE SPECIFICATIONS—ELDORADO ONLY

Material Number	Application	Size	Foot-Pounds
280M	Bearing Retainer/Splash Shield to Knuckle	3/8-16	30
286M	*Brake Backing Plate to Rear Axle Housing	3/8-24	35
301M	Upper Ball Joint Nut	1/2-20	60
	For other Torque Specifications Refer to Page 5-31		

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)

***CAUTION:** *This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

SPECIFICATIONS

Item		Eldorado Series Cars
Swept Braking Area (in square inches)		
Front		224
Rear		138
Lining Area (in square inches)		
Front		42
Rear		84
Wheel Cylinder Bore		
Front		2-15/16"
Rear		15/16"
Drums (inside diameter)		11.00"
Remachined Drum Diameter (maximum)		11.06"
Worn Drum Diameter (maximum)		11.09"
Variations of Inside Drum Diameter (maximum)		.002"
Run-Out of Inside Drum Diameter		.005"
Lateral Run-Out of Disc on Hub (Maximum)		.008"
Flatness and Parallelism Between Frictional Surfaces of Disc		.0005"
Minimum Disc Thickness		1.190"
Lining Size (length, width, thickness in inches)		
Front	Inner Shoe	5.4 x 1.93 x .43
	Outer Shoe	5.4 x 1.93 x .41
Rear		
Primary		9.00 x 2.00 x .20
Secondary		12.00 x 2.00 x .29
Lining to Shoe Attachment Method Rear		Rivets
Front		Brass Eyelet
Brake Combination Valve		
Front Brake Cut-in Pressure		130 psi
Front Brake Blend Pressure		650 psi
Rear Brake Proportioning Pressure Except with Track Master		41% above 350 psi
Rear Brake Proportioning Pressure with Track Master		41% above 470 psi
Failure Warning Differential Pressure		100-300 psi

THEORY OF OPERATION

Purpose of System

Wheel or brake lock-up occurs when the brake is applied so tightly that the wheel is held from turning and skids on the road surface. Since a tire will skid about as easily in one direction as another, a car with locked rear wheels may yaw or swerve, sending the rear end out of control. In severe cases this yaw may result in "spin-out".

Skidding may also increase the distance in which the car may be stopped as friction developed between tire and road surface may be less when sliding than when rolling, especially on a wet surface.

To improve maximum braking characteristics, the Track Master System is available as optional equipment. The primary purposes of the system during a panic stop or other hard application of brakes are: (1) maintain lateral stability of the car; (2) provide near maximum controlled braking effort to decrease stopping distance, on most road surfaces; (3) prevent flat spots on tires.

Controlling Rear Wheel Lock

All of these objectives are obtained by keeping the rear wheels rolling, with the brakes applied as tightly as possible, without actually locking the rear wheels. In practice, improvement in lateral stability is significant under most driving conditions, while decrease in stopping distance is most effective on wet pavements.

Basic Operation

Most car stops are at low rates of deceleration, with only a moderate application of force to the brakes, and the Track Master System is inoperative. However, the system is energized whenever the ignition is on, and it stands ready to function whenever a rear wheel is about to lock – whether as a result of an emergency stop with good tires on dry concrete or just a slow stop with worn tires on a wet or icy road.

Skid control starts with a speed indication taken from a magnetic pick-up device known as the sensor. The sensor produces an electrical frequency that is proportional to wheel speed. This frequency is monitored by the controller.

When a wheel is not locking during brake application, the wheel will gradually decelerate. However, when a wheel has started to lock, it will decelerate abruptly at a rate much faster then the car's deceleration.

When the controller determines that the frequency changes too rapidly and the car is thereby approaching a skid condition, the controller sends an electrical signal to the modulator solenoid.

The modulator seals hydraulic pressure from the brake master cylinder and then increases the hydraulic fluid volume from the modulator to the rear wheel cylinders. This increased volume results in decreased hydraulic pressure and partial brake release.

With the rear brakes partially released, the wheels accelerate and, as car speed is approached, the controller senses the condition and de-energizes the modulator.

This action positions the modulator to increase brake pressure to the rear wheel cylinders until a locking condition is again sensed. The entire cycle of partial brake release and re-application occurs in about 1/3 of a second. During a stop where brake pressure is sufficient to cause lock-up, the cycling will continue until the car is slowed to approximately five miles per hour, or until the brakes are released by the driver.

Control of Circuits

Figure 5-52 and 5-53 illustrate the total Track Master System control circuits.

a. Hydraulic Control Circuit

In addition to the normal brake system components (dual master cylinder, brake combination valve, front wheel cylinders, rear wheel cylinders, connecting brake lines), the hydraulic control circuit also includes the hydraulic check valve. This valve, which is an integral part of the modulator assembly, is connected between the brake combination valve and rear brake wheel cylinders.

b. Vacuum Control Circuit

This vacuum control circuit includes the vacuum hose connection from the engine manifold, vacuum check valve, valve section of the solenoid valve, and actuator section of the modulator assembly. The vacuum control circuit provides the power necessary to operate the modulator.

c. Electrical Control Circuit

This electrical control circuit includes the controller, solenoid section of the solenoid valve, speed sensor and modulator travel switch. Electrical power is supplied to the Track Master System when the ignition switch is turned to all positions except "OFF" and "Accessory".

Each time the ignition switch is turned on, a momentary ground is created in the transistorized circuitry of the controller, energizing the modulator solenoid. An audible sound accompanies this exercising cycle, indicating operation.

35. Major System Components

a. Wheel Speed Sensor

The speed sensor, on all cars except Eldorado mounts in the transmission in place of the speedometer driven gear assembly. Both the driven gear and flexible shaft coupling are integral parts of the sensor. Since the rear wheels of a rear-wheel drive vehicle are connected through the differential and transmission, the one transmission speed sensor produces an effective speed signal.

The wheel sensor on the Eldorado is mounted into the rear wheel backing plate and secured with a screw. Since the rear wheels of a front-wheel drive vehicle rotate independently, one wheel speed sensor is required

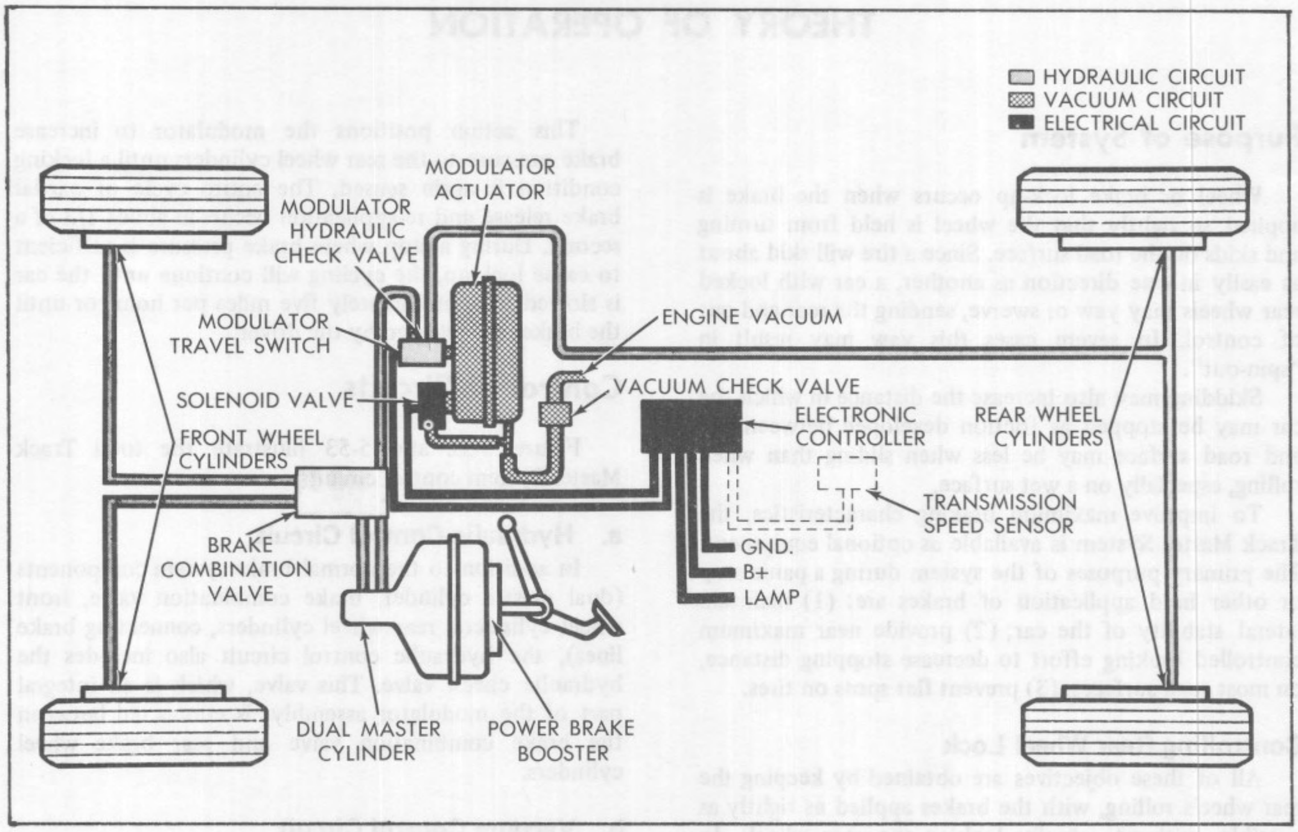


Fig. 5-52 Control Circuits—Exc. Eldorado

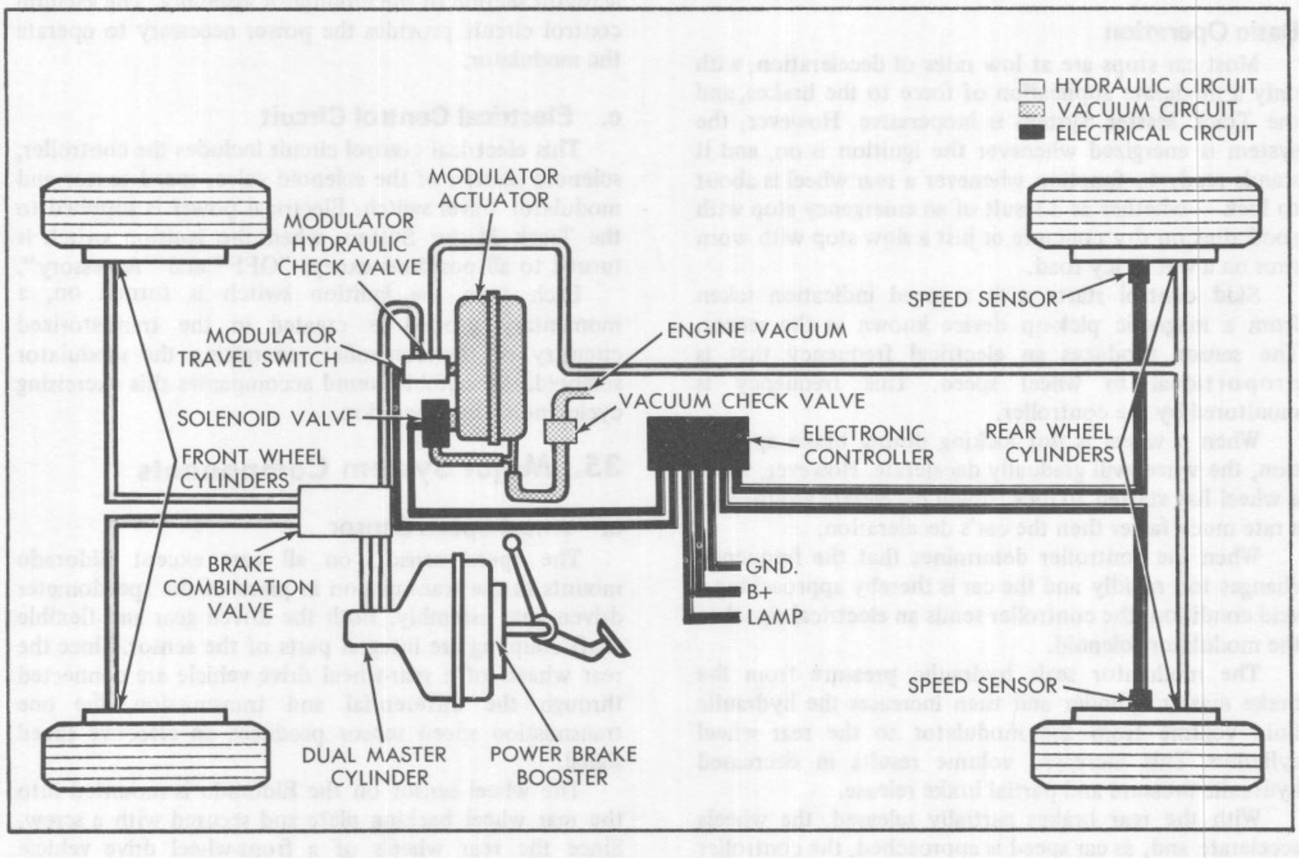


Fig. 5-53 Control Circuits—Eldorado

for each rear wheel. The outputs of the sensors are electronically combined in the controller. The sensors are serviced only as complete assemblies.

b. Controller

The controller is the electronic computer in the Track Master System.

The controller receives and continuously monitors the input speed signals from the two wheel speed sensors in the case of the Eldorado, or the transmission speed sensor in the case of all cars except Eldorado. Its basic functions are to determine from the input speed signal when rear wheel lock-up is impending, to provide an electrical output which automatically partially releases the rear brakes, to determine when the impending rear wheel lock-up situation ceases to exist, and again apply the rear brakes.

c. Modulator

The modulator with the integral solenoid valve is mounted on the left side of the cowl. Its basic function is to control or pulse the hydraulic pressure to the rear brakes during maximum braking stops, similar to pumping the brake pedal with your foot.

Included as parts of the overall modulator assembly are a vacuum check valve and solenoid valve. Electrical connections are made to the solenoid valve and travel switch, engine vacuum is connected to the vacuum check valve, and hydraulic connections are made to the rear brakes (outlet port) and brake combination valve (inlet port).

d. Solenoid Valve

The solenoid valve is a three-way vacuum valve which is operated by the electro-magnetic action of a solenoid. It is mounted through a grommet as an integral part of the modulator. Sensing that rear wheel lock-up is imminent, the controller sends an electrical signal to the solenoid valve. Its basic function is to convert this electrical signal into an air pressure signal which is used by the modulator.

The resulting action of the modulator is to release the rear brakes. During a maximum braking stop, the solenoid valve will continue to cycle, alternately supplying air or vacuum to the modulator, until the vehicle speed is less than five miles per hour or until the brakes are released by the driver.

e. Brake System Warning Light

The brake system warning light, located in the instrument panel, normally indicates that the brake system has sustained a loss of hydraulic pressure to either the front or rear brakes. The bulb and circuit are checked with the ignition switch in the "START" position, where the "BRAKES" light should be illuminated.

For vehicles equipped with the Track Master option, the brake system warning light also operates in conjunction with the modulator travel switch and special circuitry in the controller to provide a visual indication to the driver in the event of most Track Master System malfunctions. When the travel switch is open more than approximately four seconds (except during a skid controlled stop), the controller turns the tell-tale light on. An exception to this is an open in the 4 amp feed circuit from the ignition switch, which is indicated without the four second delay. When a malfunction is detected, the warning light is illuminated and remains illuminated until the ignition switch is turned off. Any malfunction indication requires immediate inspection of the warning system, the hydraulic system, or Track Master System.

In the event of many types of malfunctions, the rear brake operation automatically reverts to a standard system; i.e., normal operation without the Track Master System option. For certain malfunctions, the restoration of standard brakes is accomplished by a special controller circuit which prevents the generation of an output brake release signal whenever a malfunction indication signal exists in the brake system warning light circuit.

f. Electrical Harness

1. The C-car Track Master wiring harness consists of a body harness running from the transmission sensor to the controller; and a controller and modulator harness, running from the controller to the ignition circuit and modulator.

The solenoid cable is unique in that it has a single conductor with a braided copper shield and insulating jacket. Contrary to usual practice, the shield is not at ground potential, but is at battery potential. This has been done so that if the solenoid cable is shorted, the control system fuse will blow and the brake system will function in a standard manner. If the system were not designed to blow the fuse, a short in the ground side of the solenoid circuit (light green wire) would keep the rear brakes continuously released.

2. The Eldorado Track Master System wiring harness consists of three main sections: rear axle harness, which runs from the rear wheel sensors to a rear axle harness connector; front harness running from the rear axle harness connector to the controller; and a controller and modulator harness, running from the controller to the ignition circuit and modulator.

Connectors for the speed sensors and solenoid valve are molded waterproof-type with appropriate clamps to aid sealing.

(NOTE: Connectors to the speed sensors must be packed with front wheel bearing grease as well as clamped.)

DIAGNOSIS

36. Diagnosis

a. How to Use Diagnosis Guide

The operation of the brake tell-tale light is important when analyzing a Track Master problem. Any abnormal brake light indication means there is a problem in the hydraulic system or the Track Master System. In addition, if the light does come on, it is more important to know if turn on is immediate or there is a delay. The lack of an exercise cycle or the presence of false cycling also indicates a Track Master problem. The diagnosis guide, in large part, is based on these four underlined characteristics and a definition for each is listed in Part b.

Most problems will fall into one of these conditions. However, the system may exhibit none of the four failure characteristics and still not cycle during an impending wheel lock.

If an owner complains of this situation, the only recourse is to observe the operation under wheel lock conditions. Part c is a test used to simulate wheel-lock so the operation of the system may be observed.

After it is positively determined that a problem exists, the first step is to remove the system in-line 4 amp fuse, disconnect both controller connectors and use an ohmmeter to check for the presence of open or short circuits as described in Part d.

The diagnosis guide, Part 3, is keyed to information obtained in Parts b, c, and d.

b. Definitions

Definition of "Immediate" Brake Light:

The brake light comes on immediately when the ignition switch is turned to the "ON" position.

Definition of "Delayed" Brake Light:

A delayed brake light comes on two to five seconds after the ignition switch is turned to the "ON" position. When a delayed brake light is encountered, it is normally the result of the Track Master self-check circuitry detecting a problem in the system. When this occurs, the self-check circuit latches off the Track Master and latches the brake lamp on. Finding the problem and taking corrective action at this time (with the ignition on) will not result in the brake light going off, as it is latched on. In order to reset the Track Master self-check circuit and turn the brake lamp off, it is necessary to turn the ignition off. After doing so, it may be again turned on and the engine started, to evaluate the corrective action and/or continue the diagnosis procedure.

Definition of Exercise Cycle:

Each time the ignition switch is turned on, the Track Master controller sends a short signal to the modulator assembly. This signal energizes the solenoid valve, which in turn allows the modulator to partially cycle if there is vacuum in the system. This exercise cycle can be detected audibly or by feeling the modulator while someone turns the ignition switch on; however, the only positive way to determine if the exercise cycle is normal is to check it with vacuum in the system (running engine for a few seconds will provide sufficient vacuum) and with an ohmmeter connected from the modulator travel switch terminal to ground. If the ohmmeter reading indicates that the modulator travel switch has changed from "closed" to "open" and back to "closed" again when the ignition switch is turned to the "on" position, the exercise cycle is normal.

Definition of False Cycling:

The Track Master System's basic function is to maintain vehicle stability during maximum effort stops by keeping the rear wheels from skidding. This action can take place at varying degrees of brake pedal effort as determined by brake effectiveness, slipperiness of road surface, etc., and normal cycling will be experienced when the controller senses the rear wheels starting to lock up. This is "normal" operation. Cycling of the system, random or otherwise, when not braking the vehicle or when light (normal) brake stops are being made would be considered "false cycling".

c. Operational Check

1. C-Car – Raise and support rear end of vehicle so the rear wheels are above the floor. Start the engine, shift into "drive" range and accelerate wheels to approximately 40 mph (speedometer). Apply the brake firmly and observe the speedometer. The speedometer should reflect the cycling of the rear wheels and should gradually approach 0 mph. Also, the cycling of the rear wheels normally can be felt as well as heard. If the speedometer goes directly to "0" mph from 40 mph when the brake is applied, the wheel lock control system is inoperative.

2. Eldorado – Raise and support rear end of vehicle so that rear wheels are above the floor. Start the engine.

Fig. 5-54 Rotating Wheel

Use the following procedure for each rear wheel: rotate wheel at high speed using wheel spinner of Dynamic Wheel Balancer, Fig. 5-54. Remove drive motor from wheel, apply brake firmly and observe rear wheel for cycling. If wheel stops immediately after application of foot brake, system is not operating normally.

d. Controller Connectors Check

Resistance and continuity checks should be made at the harness connectors with the controller disconnected, and with the Track Master System power lead disconnected at the 4 amp in-line fuse. Normal readings are shown in Fig. 5-55 and 5-56.

(NOTE: Since loose connections may check ok in service area but malfunction on the road due to vibration, the continuity checks should be made while vibrating the connections of wires.)

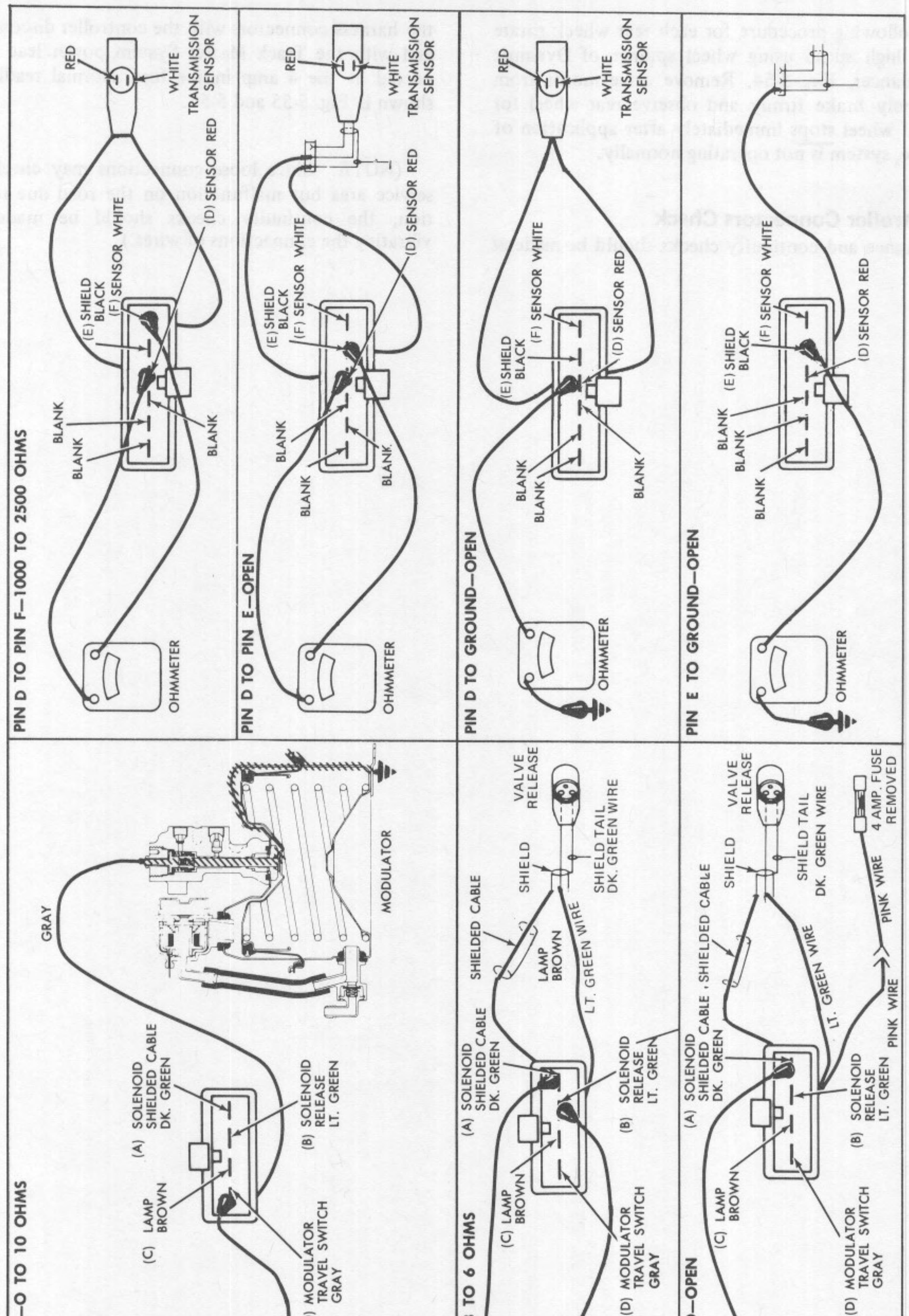


Fig. 5-55 Resistance and Continuity Checks—Exc. Eldorado

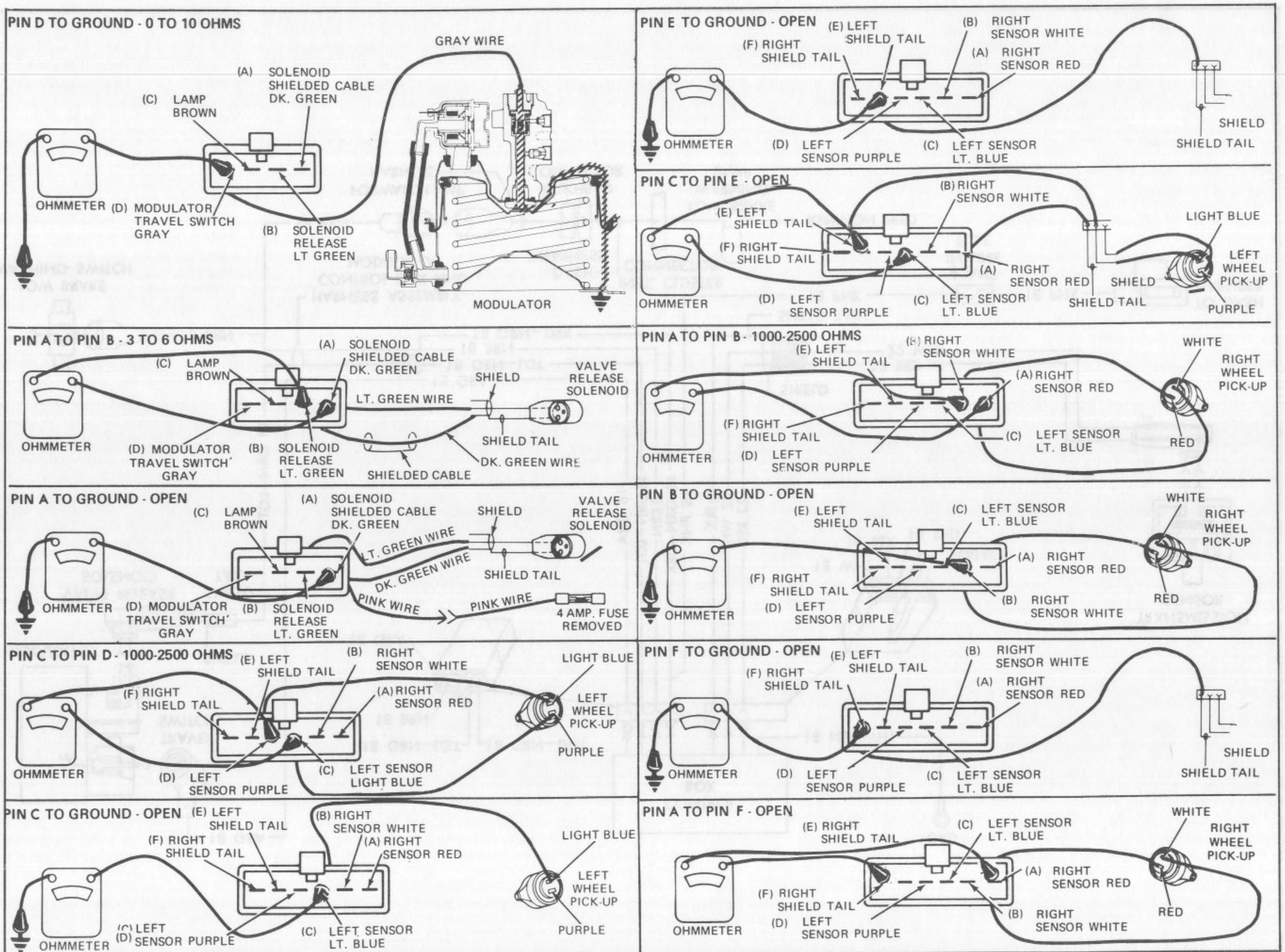


Fig. 5-56 Resistance & Continuity Checks—Eldorado

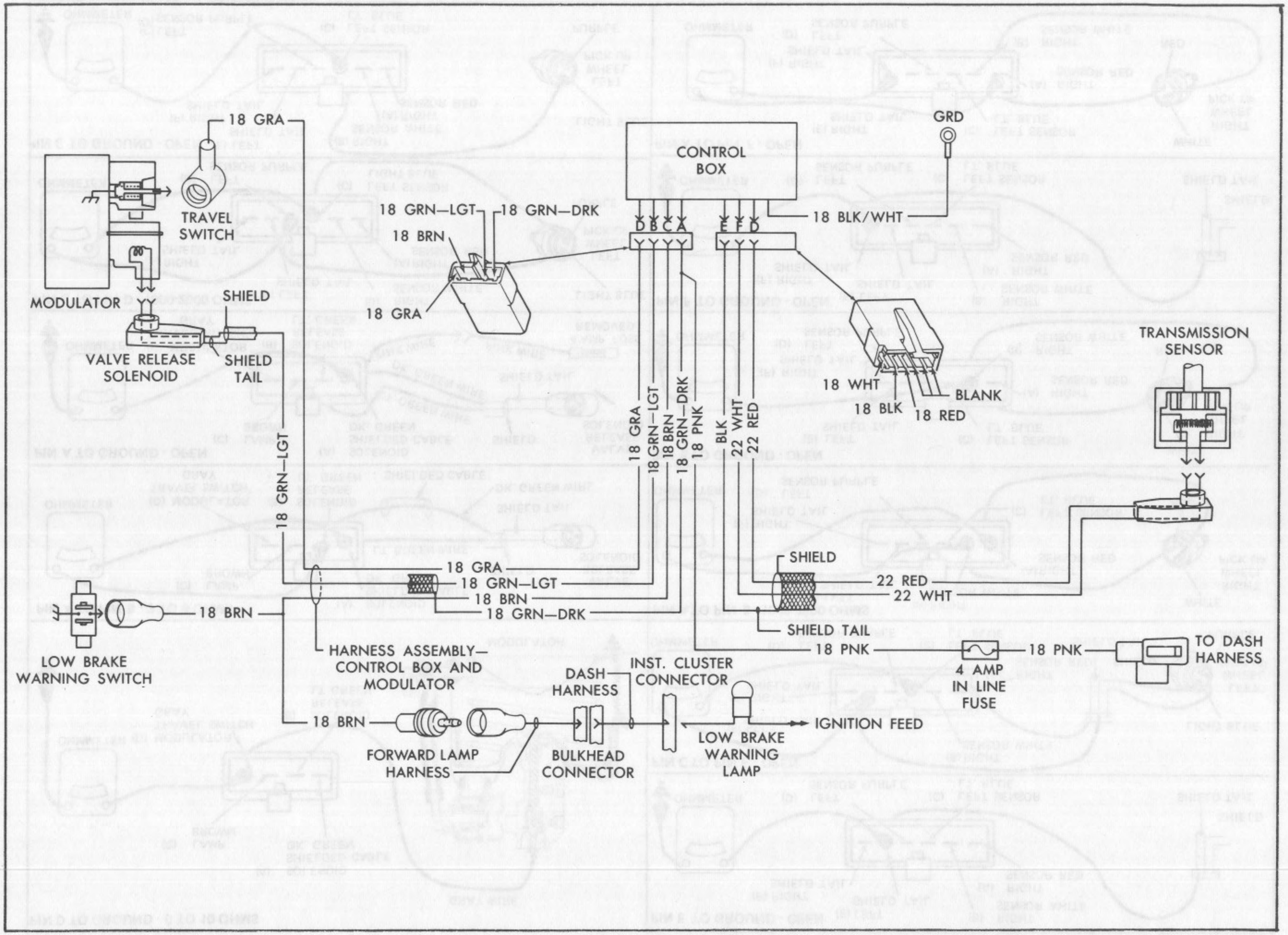


Fig. 5-57 Circuit Diagram—Exc. Eldorado

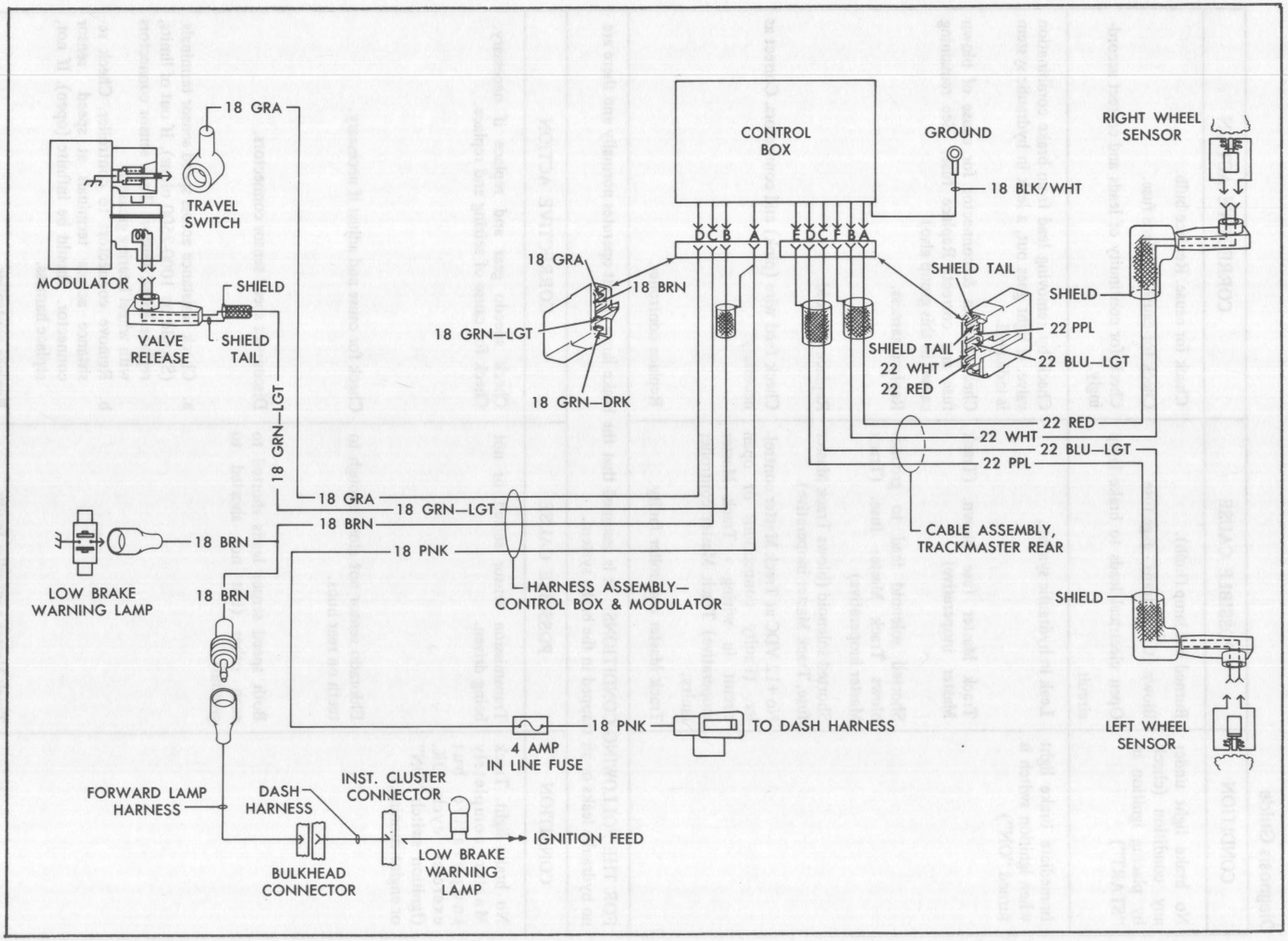


Fig. 5-58 Circuit Diaphragm—Eldorado

Diagnosis Guide

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
No brake light under any condition (check by placing ignition in "START")	Burned out lamp (bulb).	Check for cause. Replace bulb.
	Blown 10 amp trans - gage fuse	Check for cause. Replace fuse.
	Open electrical leads to brake lamp circuit.	Check for continuity of leads and correct accordingly.
Immediate brake light when ignition switch is turned "ON")	Leak in hydraulic system.	Check by removing lead from brake combination valve. If light goes out, a leak in hydraulic system is indicated.
	Track Master fuse blown. (Track Master inoperative)	Check harness & connector for cause of blown fuse and correct. Replace fuse. (See remaining causes in this group also)
	Shorted solenoid lead to ground-blows Track Master fuse. (Track Master inoperative)	Replace harness.
	Shorted solenoid (blows Track Master fuse, Track Master inoperative)	Replace solenoid.
	No +12 VDC at Track Master controller. (Faulty connections or open circuit in wiring - Track Master inoperative) Track Master controller faulty.	Check feed wire (pink) and connectors. Correct as necessary.
	Track Master controller faulty.	Replace controller.

FOR THE FOLLOWING CONDITIONS: It is assumed that the brake lamp circuit operates normally and there are no hydraulic leaks or air trapped in the brake system.

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
No brake light. Track Master completely inoperative but exercise cycle OK. (Ignition switch "ON" or engine running.)	Transmission sensor seized or not being driven.	Check speedo gear and replace if necessary. Check for cause of seizing and replace.
	Eldorado sensor not close enough to teeth on rear hubs.	Check for cause and adjust if necessary.
	Both speed sensor leads shorted to each other (but not shorted to ground)	Disconnect speed sensor connectors.
		a. Check resistance across speed sensor terminals. (Should be 1000-2500 ohms). If out of limits, replace speed sensor. (Pack sensor connectors with wheel bearing grease.) b. Remove connectors to controller. Check resistance across terminals at speed sensor connector. Should be infinite (open). If not, replace harness.
	Track Master controller faulty.	Replace controller.

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
No brake light. Track Master completely inoperative and no exercise cycle (ignition switch "ON" or engine running).	Loss of ground connection to Track Master controller.	Check ground lead connection from controller. (Black/white wire)
	Controller connector not plugged into controller and modulator harness.	Plug in connector.
	Solenoid valve seized in de-energized position.	Disconnect solenoid lead. a. Momentarily apply 12 volts to solenoid terminals and listen for solenoid core movement (sharp click). If inoperative, replace solenoid. b. Apply 12 volts to solenoid terminals for 2-3 seconds and observe if vacuum leak stops after solenoid "clicks" (with engine running). If vacuum leak does not stop, replace solenoid.
	Modulator seized in de-energized position.	Disconnect gray modulator travel switch wire. Connect ohmmeter from modulator travel switch to ground. With the engine running, pull solenoid valve out of modulator port and observe ohmmeter. If ohmmeter reflects a change from very low resistance to high resistance as the solenoid valve is removed, the modulator is OK. If not, replace the modulator.
	Track Master controller faulty.	Replace controller.
Brake light comes on after a 2-5 second delay. Track Master completely inoperative but exercise cycle OK. (Ignition switch "ON" or engine running.)	Speed sensor leads open	Check speed sensor connectors and pack with front wheel bearing grease. Secure connection with clamps. Disconnect connectors and check continuity across sensor terminals - should be 1000-2500 ohms. If not, replace sensor(s). Remove connectors to controller and check resistance across terminals at harness connector with the speed sensor connector(s) reconnected (should be 1000-2500 ohms) - if open, replace harness.
	Speed sensor lead(s) shorted to ground.	Disconnect speed sensor connectors and check continuity of speed sensor terminals to ground. If any terminal is grounded, replace speed sensor. Remove connectors to controller. Check continuity of speed sensor connector terminals to ground. If any terminals are grounded, replace harness.
	Modulator travel switch open.	Remove gray wire connector from modulator travel switch terminal. Check for 0-10 ohm resistance reading from terminal to ground. If out of limits, replace modulator.
	Modulator travel switch connector not making contact with the terminal or open circuit in the lead.	Check gray wire connector at modulator travel switch terminal for security. Remove gray wire modulator travel switch connector from terminal and insert jumper from connector to ground. If system now operates

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Brake light comes on after a 2-5 second delay. Track Master completely inoperative but exercise cycle OK. (Ignition switch "ON" or engine running.) (Cont'd.)	Modulator travel switch connector not making contact with the terminal or open circuit in the lead. (Cont'd.)	normally, the travel switch is faulty, requiring modulator replacement. If system is still inoperative, check continuity of modulator travel switch lead. If open, replace harness.
	Track Master controller faulty.	Replace controller.
Brake light comes on after a 2-5 second delay. Track Master completely inoperative and no exercise cycle. (Ignition switch "ON" or engine running.)	Solenoid lead(s) open.	Check connector at solenoid valve for security. Remove connector and check resistance of solenoid (3-6 ohms). If out of limit, replace solenoid. Remove controller and modulator harness connector at controller. Also disconnect pink 12 volt feed wire to harness by removing in-line 4 amp fuse. Check continuity of terminals C & D, Fig. 5-55 and/or 5-56, at the harness connector with a jumper temporarily inserted across the solenoid valve connector terminals. If open, replace harness.
	Track Master controller faulty.	Replace controller.
False cycling while vehicle is in motion.	Frayed shield leads causing intermittent short.	Visually check shields leads and connectors for stray strands of wire. Repair or replace harness as required.
	Improperly greased sensor connector or missing clamp.	Pack connector with front wheel bearing grease and clamp connection.
	Bad electrical connections.	Clean connector.
	Track Master controller faulty.	Replace controller.
	Improper sensor adjustment on Eldorado.	Adjust correctly.
False cycling while vehicle is parked (with engine running or ignition switch "ON").	Bad electrical connections.	Clean the connection, pack with front wheel bearing grease and properly clamp connection.
	Track Master controller faulty.	
Does not cycle down to 5 mph during maximum braking effort stop.	Insufficient operating vacuum.	Look for severe vacuum leak and correct.
	Track Master controller faulty.	Replace controller.
Brake light on 2-5 seconds after high brake pressure is applied.	Defective brake combination valve (excessive pressure applied to modulator).	Replace brake combination valve.

SERVICE INFORMATION

CAUTION: To prevent controller damage never operate the Trackmaster System unless the controller has a good ground. Never reverse battery polarity and always connect battery booster cables positive to positive and negative to negative.

37. Transmission Speed Sensor (Fig. 5-59)

a. Removal

1. Disconnect speedometer cable at transmission sensor.
2. Release clamp at harness connector and remove connector from sensor being careful not to twist connector as this may crack the sensor body.
3. Remove one bolt, retainer and spacer securing sensor to transmission.
4. Remove sensor from transmission.

b. Installation

1. Install sensor with speedo gear in transmission.
2. Install spacer, retainer and bolt securing sensor to transmission.
3. Install harness connector packed with front wheel bearing grease to sensor and secure with clamp being careful not to twist connector as this may crack the sensor body.
4. Connect speedometer cable to sensor.

38. Wheel Speed Sensor (Fig. 5-60) (Eldorado Only)

a. Removal

1. Raise car on hoist.
2. Release clamp at harness connector and remove connector from sensor, being careful not to twist connector as this may crack the sensor body.
3. Remove one screw securing sensor to backing plate.
4. Remove wheel speed sensor.

b. Installation

(NOTE: If new sensor is to be installed it will be furnished with a piece of pressure sensitive tape on the pick-up end. This tape must be left on.)

1. Install sensor in backing plate so that taped end contacts teeth on hub.

(NOTE: Place a .010" blade feeler gage between sensor and hub, use only if no tape is present on end of sensor, Fig. 5-61. When feeler gage is used it will be necessary to remove wheel disc, wheel, and brake drum.)

2. While holding sensor against hub secure sensor to backing plate with one screw and tighten to 75 inch pounds.
3. Remove feeler gage if used.

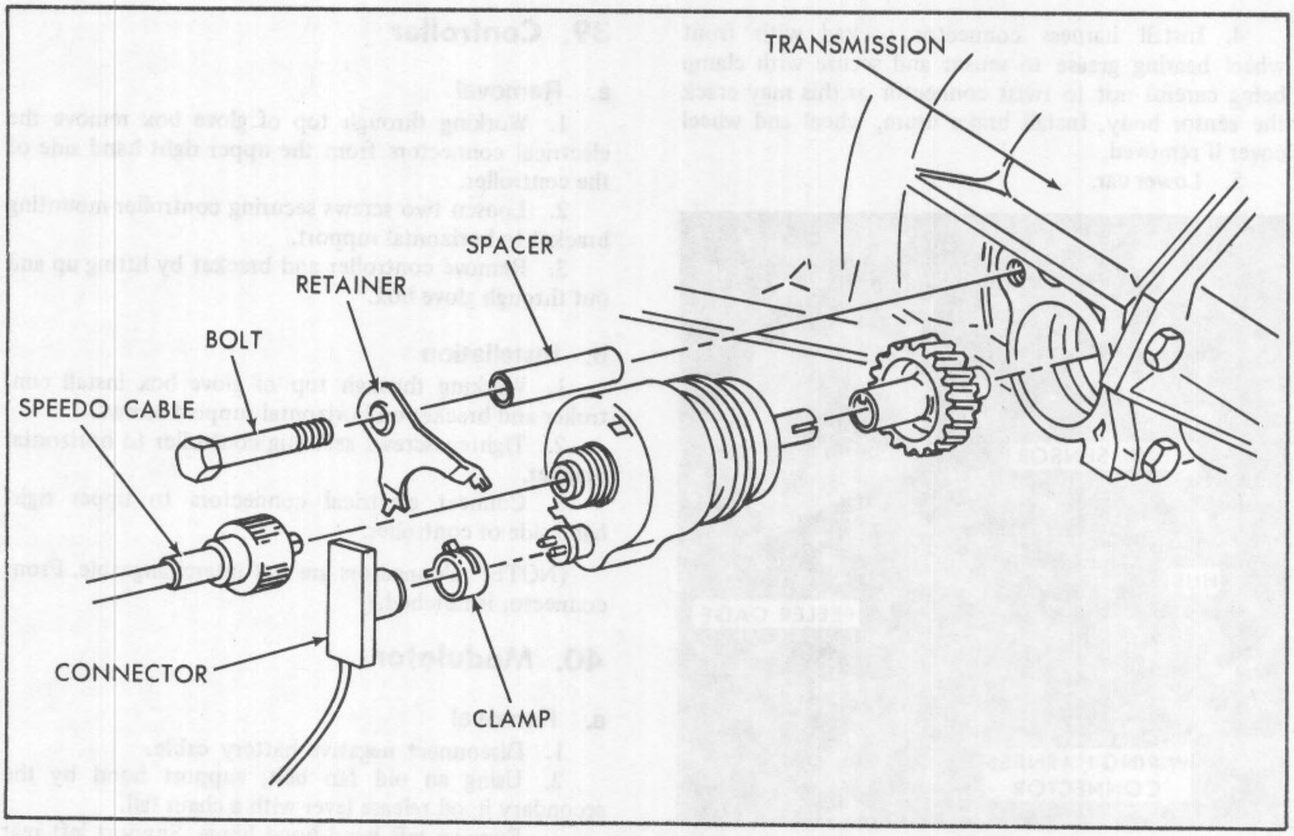


Fig. 5-59 Transmission Sensor Installation

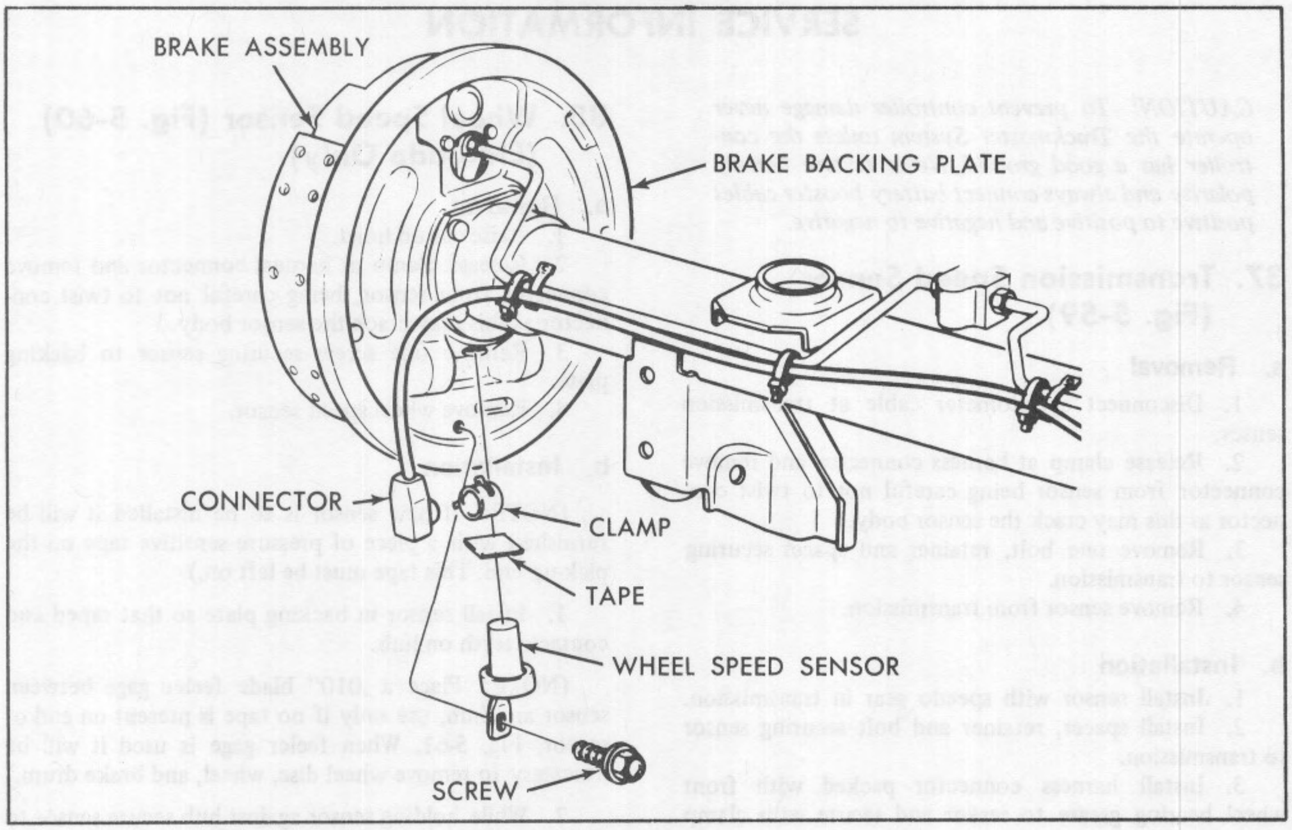


Fig. 5-60 Wheel Sensor Installation

4. Install harness connector packed with front wheel bearing grease to sensor and secure with clamp being careful not to twist connector as this may crack the sensor body. Install brake drum, wheel and wheel cover if removed.

5. Lower car.

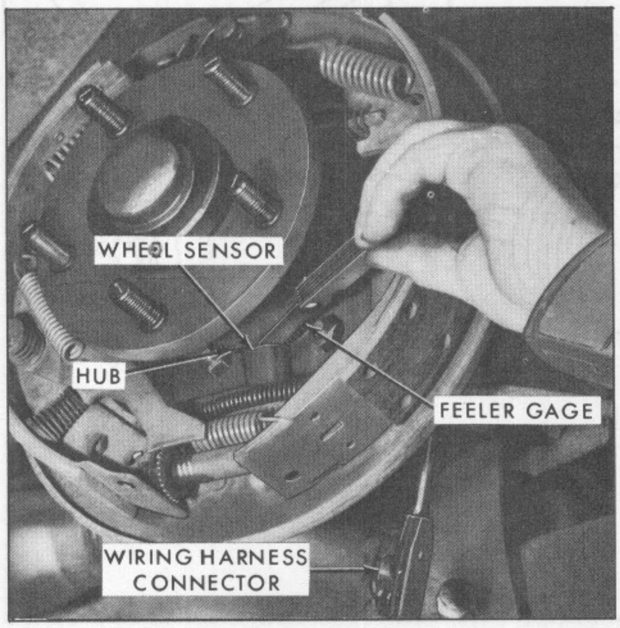


Fig. 5-61 Gaging Wheel Speed Sensor

39. Controller

a. Removal

1. Working through top of glove box remove the electrical connectors from the upper right hand side of the controller.

2. Loosen two screws securing controller mounting bracket to horizontal support.

3. Remove controller and bracket by lifting up and out through glove box.

b. Installation

1. Working through top of glove box install controller and bracket on horizontal support screws.

2. Tighten screws securing controller to horizontal bracket.

3. Connect electrical connectors to upper right hand side of controller.

(NOTE: Connectors are not interchangeable. Front connector is notched.)

40. Modulator

a. Removal

1. Disconnect negative battery cable.

2. Using an old fan belt, support hood by the secondary hood release lever with a chain fall.

3. Remove left hand hood hinge. Support left rear of hood with a block of wood.

4. Disconnect travel switch and solenoid connectors at modulator.

5. Remove vacuum hose at check valve assembly.

(NOTE: The only serviceable components of the modulator are the check valve assembly, solenoid assembly and modulator without check valve or solenoid.)

6. Disconnect two brake lines at modulator assembly.

7. Remove three screws that secure modulator to cowl and remove modulator.

b. Installation

1. Install modulator on cowl and secure with three screws. Tighten screws to 85 inch pounds.

2. Connect solenoid and travel switch connectors.

3. Install solenoid and check valve assemblies with vacuum hoses attached.

4. Secure two brake lines at modulator assembly.

5. Install left hand hood hinge.

6. Release chain fall and remove fan belt from secondary latch.

7. If pressure bleeding equipment is available, proceed to Step 8. If not, proceed to Step 14.

8. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with brake fluid.

9. Install Bleeder Adapter, J-22489-1 and J-22489-12 cables on master cylinder and connect bleeder hose to Bleeder Adapter Cover.

10. Build up pressure in bleeder 30 psi minimum and bleed system at modulator as described in Steps 11 and 12.

11. Attach drain hose at bleeder fitting.

12. Back off fitting one-half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting.

13. Raise car on hoist and first bleed right rear and then left rear brake following procedure outlined in Steps 11 and 12. Proceed to Step 17.

14. If a pressure bleeder is not available the following two man procedure may be used to bleed the rear brakes. Fill both master cylinder reservoirs with brake fluid.

(NOTE: Keep reservoirs at least partially filled at all times during bleeding operation.)

15. Bleed system at bleeder fittings in the following order: modulator; right wheel; left wheel; using procedure described in Step 16.

16. Attach drain hose to bleeder fitting. Apply pressure to brake pedal, back off fitting one-half turn, and depress brake pedal. Close bleeder fitting before releasing pressure on brake pedal. Repeat applications until bubbles stop.

17. Master cylinder reservoir level should be 1/8" to 3/8" from top. Before driving car, be sure a firm pedal is obtained.

18. Connect negative battery cable.

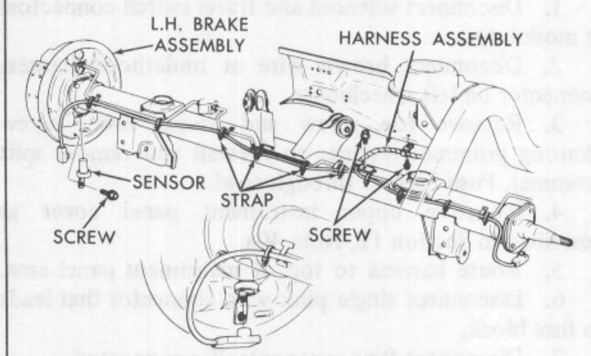


Fig. 5-62 Securing Harness to Axle—Eldorado

41. Solenoid

a. Removal

1. Remove vacuum hoses.
2. Remove solenoid connector.
3. Remove solenoid.

b. Installation

1. Install solenoid on modulator, securing two vacuum hoses.

2. Install solenoid connector.

42. Rear Axle Harness (Eldorado Only) (Fig. 5-62)

a. Removal

1. Raise car on hoist.

2. Remove plastic straps securing harness to frame and rear axle.

3. Release clamps at harness connectors and remove connectors from sensors being careful not to twist connector as this may crack the sensor body.

4. Disconnect speed sensor connectors from speed sensors.

5. Remove harness.

b. Installation

1. Pack speed sensor connectors with front wheel bearing grease.

2. Position harness and install speed sensor connectors on speed sensor securing with clamps being careful not to twist connector as this may crack the sensor body.

3. Connect harness connectors.

4. Install plastic straps securing harness to rear axle and frame.

5. Lower car.

43. Controller and Modulator Harness

a. Removal

1. Disconnect solenoid and travel switch connectors at modulator.
2. Disconnect brown wire at underhood harness connector on left wheelhouse.
3. Remove top screw and loosen lower screw securing grommet retainer to firewall and remove split grommet. Push harness through cowl.
4. Remove upper instrument panel cover as described in Section 12, Note 40a.
5. Route harness to top of instrument panel area.
6. Disconnect single pink wire connector that leads to fuse block.
7. Disconnect four-way controller connector.
8. Remove controller and modulator harness.

b. Installation

1. Position harness on top of instrument panel area and route to pink lead to controller.
2. Connect four-way controller connector.
3. Connect single pink wire connector that leads to fuse block.
4. Route harness through cowl.
5. Connect solenoid and travel switch connectors at modulator.
6. Connect brown wire connector at underhood harness connector on left wheelhouse.
7. Install split grommet in retainer and install top screw and tighten lower screw securing grommet retainer to cowl.
8. Install upper instrument panel cover as described in Section 12, Note 40b.

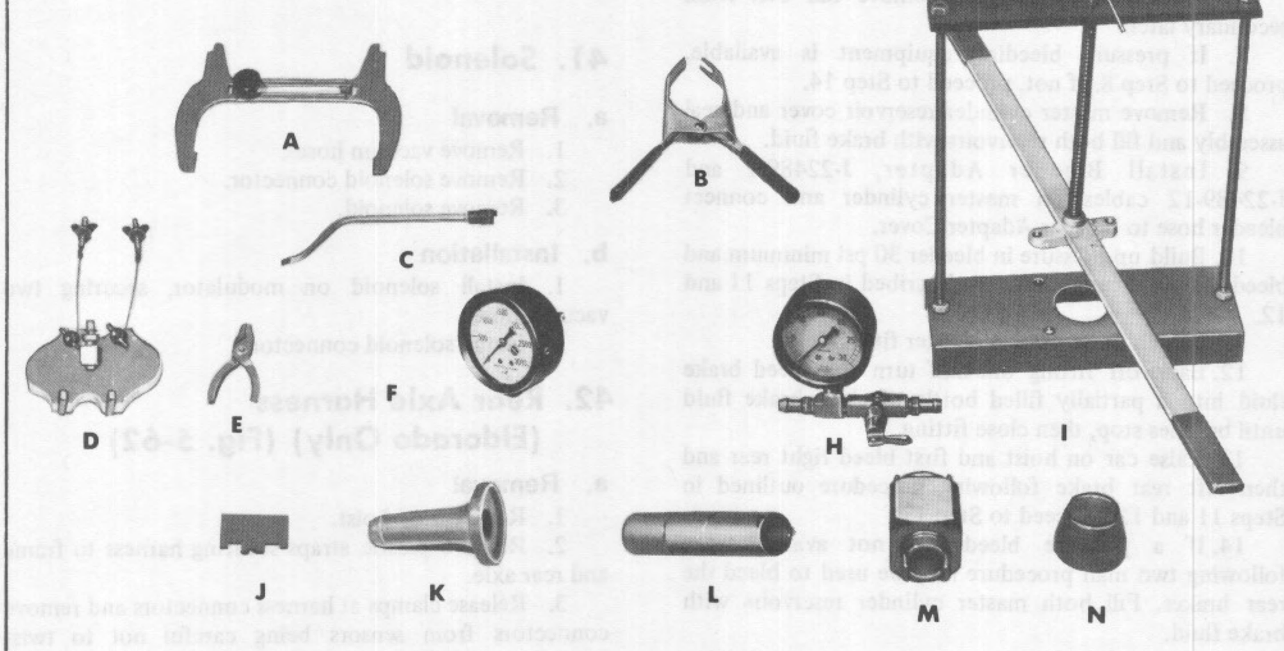


Fig. 5-63 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21177	Brake Adjusting Caliper	H	J-23108	Leak Testing Adapter
B	J-23770	Brake Combination Valve Bleeder	I	J-22884	Power Unit Holding and Separating Fixture
C	J-8049	Brake Spring Remover and Installer	J	J-22647	Push Rod Gage
			K	J-22904	Boot Installer
D	J-22489-1	Brake Bleeder Adapter	L	J-23175	Control Valve Retainer Installer
	J-22484-12	Bleeder Adapter Cover Cables			
E	J-4880	Snap Ring Pliers	M	J-23101	Power Piston Holding Fixture
F	J-21601	Control Valve Installer	N	J-23188	Seal Protector

Subject	Page No.
Engine Cooling	6-2
Engine Electrical	6-14
Engine Fuel	6-53
Emission Control Systems	6-87
Engine Mechanical	6-101

GENERAL DESCRIPTION

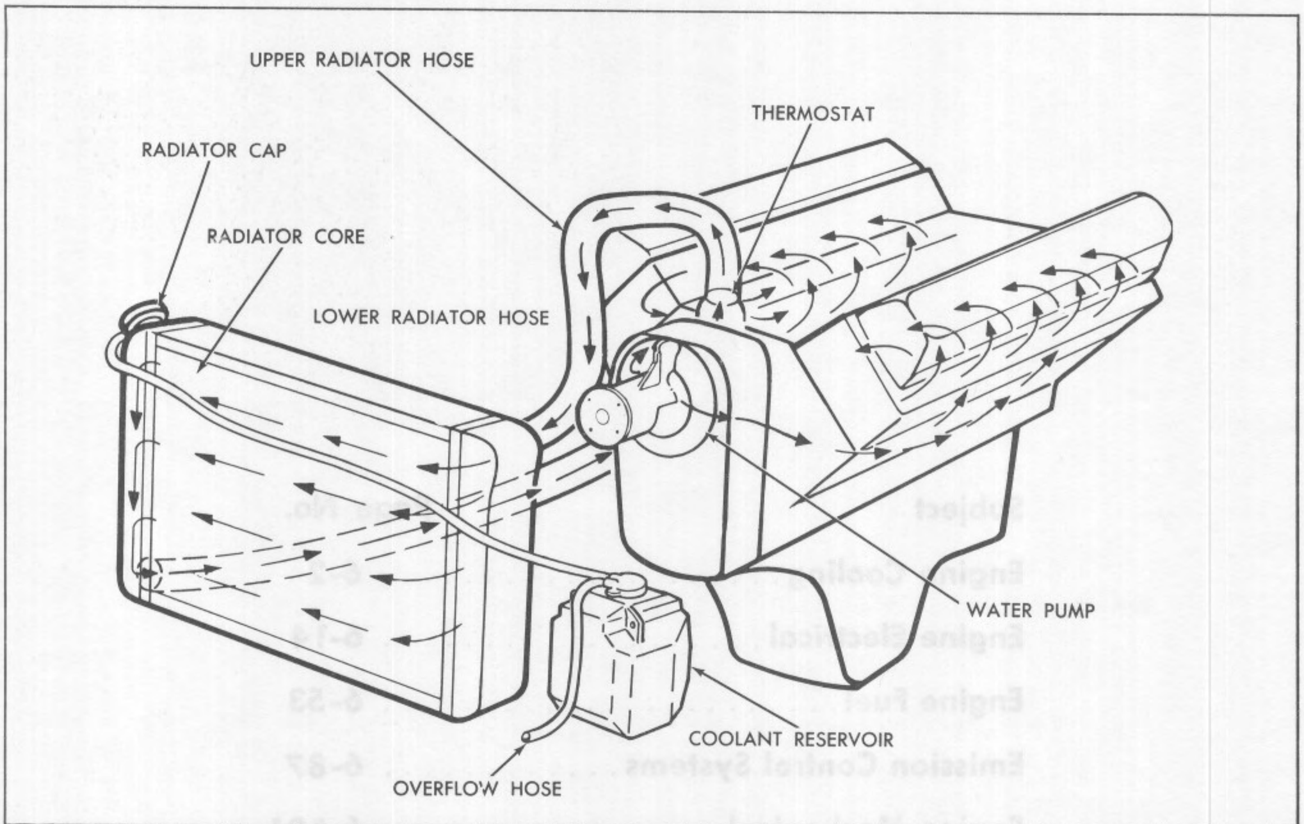


Fig. 6-1 Flow of Coolant

The cooling system is designed to be kept closed at all times. A coolant reservoir, Fig. 6-1, keeps the system full, indicates the need for additional coolant, and allows coolant to be added without removing the radiator cap.

A vented radiator cap is used, which allows the coolant to expand through the normally open vent valve in the center of the cap without building unnecessary pressure. The expanding coolant flows into the coolant reservoir. The vent valve closes when the temperature of the coolant nears the boiling point and pressure is needed to control boiling. The 15 pound pressure will not be reached until the system is working at maximum capacity.

Any air or vapor in the cooling system is forced into the coolant reservoir under the liquid level and exhausts through the overflow hose at the top of the reservoir. As the system cools, extra coolant in the reservoir is drawn back to the radiator through the vent valve. In this manner, the radiator is kept full at all times. The need for additional coolant can be detected by observing the level of coolant in the reservoir while the engine is at normal operating temperature.

The radiator cap, Fig. 6-2, should only be removed when draining and refilling the system or whenever it becomes necessary to add coolant because of lack of coolant in the reservoir, or when coolant has not been moving in and out of the reservoir.

WARNING: IF THERE IS EVIDENCE OF STEAM, DO NOT OPEN HOOD UNTIL STEAM IS DISPERSED.

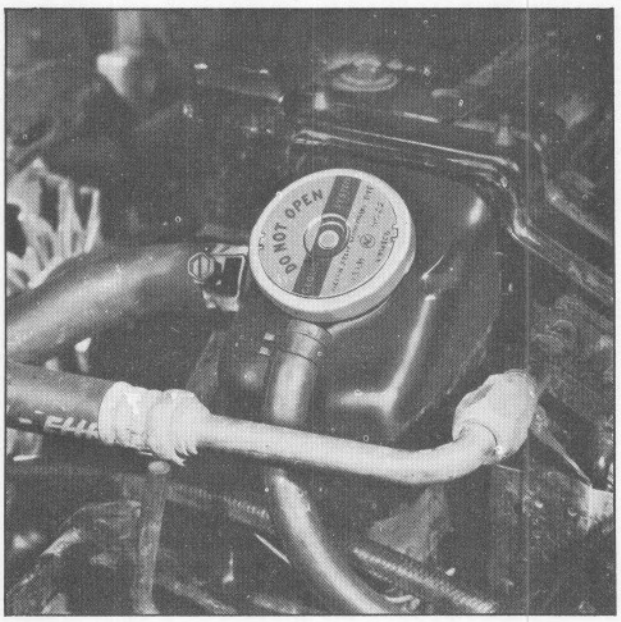


Fig. 6-2 Radiator Cap

Two different fan designs are used to meet the cooling requirements on Cadillac cars. All cars equipped with the standard heating system use a seven bladed fan with flexible blades. On cars equipped with air conditioning a seven bladed solid fan and thermostatic clutch is used. Cars equipped with the optional trailer towing package or heavy duty cooling package use a seven bladed flexible fan without fan clutch regardless of whether air conditioning is ordered or not. In addition, the limousine and commercial chassis cars will also use a seven bladed flexible fan.

The fan clutch is serviced only as an assembly and is designed to reduce fan speed and noise as engine cooling needs become less (engine is cold) or to maintain fan speed should cooling needs increase (engine is warm).

The flex fan is designed so that the blades flatten out (decrease their pitch) at high engine speeds when additional air flow is not needed due to the "ram air" provided by vehicle motion.

The fan assemblies are illustrated in Fig. 6-7.

WARNING: IT IS ESSENTIAL THAT FAN ASSEMBLIES REMAIN IN PROPER BALANCE AND PROPER BALANCE CANNOT BE ASSURED ONCE A FAN ASSEMBLY HAS BEEN BENT OR DAMAGED. A FAN ASSEMBLY THAT IS NOT IN PROPER BALANCE COULD FAIL AND FLY APART DURING SUBSEQUENT USE CREATING AN EXTREMELY DANGEROUS CONDITION.

IF A FAN BLADE IS BENT OR DAMAGED IN ANY WAY, NO ATTEMPT SHOULD BE MADE TO REPAIR AND REUSE THE DAMAGED PART. A BENT OR DAMAGED FAN ASSEMBLY SHOULD ALWAYS BE REPLACED WITH A NEW FAN ASSEMBLY.

A cast iron water pump is mounted at the front of the engine. It is driven by a single 1/2 inch wide "V" belt and may be serviced as described in Note 9.

Coolant is pumped to each bank of cylinders simultaneously, then through passages to the cylinder heads, through the thermostat housing at the top of the cylinder block to the left hand radiator tank. Radiator coolant flow is from the left hand tank through the core to the right hand tank, which is the source of coolant to the water pump inlet, Fig. 6-1.

When the thermostat is closed, coolant from the cylinder heads is pumped through a by-pass passage below the thermostat housing to the water pump and recirculated. When the engine is sufficiently warm, the thermostat opens and coolant flows to the inlet tank on the left side of the radiator, and is cooled as it flows across the horizontal core tubes to the outlet tank on the right side of the radiator, completing the cycle.

The thermal vacuum valve is located in the front of the cylinder block just under the left cylinder head. It has three fittings: one to manifold vacuum, one to carburetor vacuum above the throttle valves and one to the distributor vacuum diaphragm. At coolant temperatures above 220°F, this valve switches from carburetor vacuum to manifold vacuum, advancing the ignition timing to full vacuum advance at idle. This reduces the possibility of engine overheating under extremely high temperature operation.

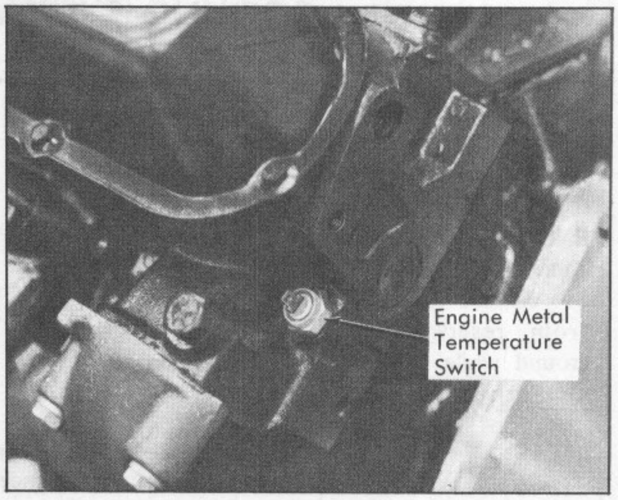


Fig. 6-3 Metal Temperature Switch

The coolant temperature tell-tale light is located in the warning light cluster at the top of the instrument panel, Fig. 12-19. The light reads "COOLANT TEMPERATURE" and glows amber whenever coolant temperature becomes excessive (260°F. or higher). The light is activated by a temperature sensitive switch in the water passage directly below the air conditioning compressor. To check operation of the "COOLANT TEMPERATURE" tell-tale light, turn the ignition switch to the Start position. The light should glow. As soon as the switch is moved away from Start, the light should go out.

In addition to the water temperature warning light, an engine metal temperature warning light and buzzer system is used.

The second tell-tale light to the right of the "COOLANT TEMPERATURE" indicator (Fig. 12-19) is a red light that reads "STOP ENGINE-TEMPERATURE". It will light whenever engine metal temperature is excessive. In addition to the glowing lamp, the key buzzer will sound.

The engine metal temperature switch, Fig. 6-3, located at the rear of the left cylinder head senses the temperature of the casting rather than the temperature of the coolant. Since the switch screws into a blind hole in the cylinder head, sealer is not required and MUST NOT be used when installing this switch.

Operation of the "STOP ENGINE-TEMPERATURE" light is checked by opening the driver's door while ignition key is in Lock or Off positions. Light should glow and buzzer should sound. The high engine temperature warning system does not utilize the ignition switch "START" ground circuit for testing operation as do the other tell-tale lights. Therefore, the red "STOP ENGINE-TEMPERATURE" light should not glow when the ignition switch is in the Start position.

The transmission oil cooler is located in the outlet tank on the right side of the radiator.

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Engine overheats (i.e., COOLANT and/or ENGINE TEMP lights come on and stay on, or coolant overflows from reservoir onto ground while engine is running).	Loss of coolant.	See "Loss of Coolant" condition below.
	Loss of system pressure.	Inspect system as described in Note 1. Check hose connections and tighten as necessary.
	Low coolant protection (should be -40°F).	Test solution as described in Note 3.
	Belt tension too low.	See Note 10.
	Spark timing incorrect.	Set timing to 10° advance.
	Timing retarded by poor function of distributor vacuum advance unit or thermal vacuum switch.	Check hose for kinks, partial collapse, or poor connections. Check thermal advance as explained in Note.
	Water pump inoperative.	Repair as required, following Note 9.
	Radiator fins obstructed.	Clean away bugs, leaves, etc.
	Cooling system passages blocked by rust or scale.	Flush system - add fresh coolant.
	Reservoir hose pinched or kinked (especially at radiator filler neck).	Relieve kinks by re-routing. Replace hose if necessary.
	Lower radiator hose collapses.	Check for hose spring position by squeezing lower end of hose. Replace as necessary.
	Defective engine metal temp switch.	Replace switch.
	Exhaust system restriction.	Check muffler and exhaust pipe for collapse.
	Thermostat stuck in closed position.	Replace thermostat.
Loss of coolant.	Leaking radiator.	Inspect cooling system as described in Note 1.
	Leaking coolant reservoir or hose.	Replace reservoir or hose.
	Loose or damaged hoses or connections.	Reseat or replace hoses or clamps.
	Water pump seal leaking.	Repair water pump as described in Note 9.
	Water pump gasket leaking.	Replace gasket.
	Radiator cap damaged, or filler neck distorted.	Inspect cooling system as described in Note 1. If neck is distorted, use wood block and mallet to reform evenly to fit cap.
	Cylinder head gasket leaking.	Replace gasket.
	Improper cylinder head screw torque.	Tighten screws to 115 foot-pounds.
	Cylinder block core plug leaking.	Replace core plug.
	Cracked cylinder head or block or warped cylinder head or block gasket surface.	Resurface or replace.
	Leaking heater core.	Repair or replace core.
	Leaking heater water control valve.	Replace valve.
Engine fails to reach normal operating temperature. (Cool air from heater.)	Thermostat stuck open or wrong type thermostat.	Install new thermostat of correct type and heat range.
	Coolant below add mark.	Add coolant.

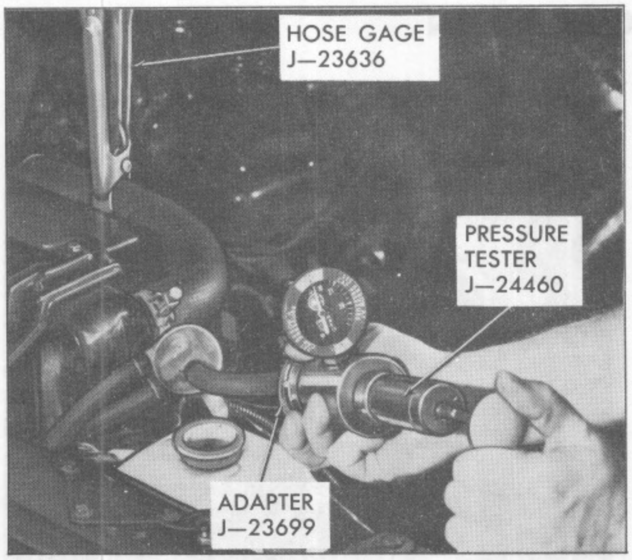


Fig. 6-4 Testing Closed Cooling System

1. System Leak Test

1. Make visual check of hoses and hose connections for leaks. Tighten clamps as required.

2. Install Hose Gage, J-23636, on upper radiator hose all the way, Fig. 6-4.

3. Before installation of Adapter, J-23699, make sure rubber seal on pressure tester is fully extended and making full contact with adapter. Install Adapter, J-23699, on Pressure Tester, J-24460.

4. Remove cap from reservoir and install pump adapter to hose on bottom of cap, Fig. 6-4. Secure with clamp.

5. Pump system to 16 psi and watch for pressure drop on pump gage.

6. If pressure drops below 16 psi in 10 seconds, the cap spring washer gasket, the filler neck nipple, or an overflow hose connection is leaking. If pressure does not drop proceed to Step 12.

7. Open drain valve on radiator and drain until all pressure is out of system. Close valve and proceed.

8. Remove radiator cap and check for weak spring washer or damage to gasket. Check overflow tube to filler neck for solder crack. Check overflow hose for loose connections at each end.

9. If spring washer in cap is weak, install new radiator cap. If nipple is loose or cracked, re-solder. If hose connection is loose, replace clamp.

10. Re-install coolant and cap. If new cap is installed, wet both top and bottom sealing gasket with coolant.

11. Re-install pump to adapter and pressurize system to 16 psi. If system holds pressure for 10 seconds, cap gasket is sealing.

12. To check cap holding pressure, set red washer on hose gage against movable handle.

13. With a <u>quick</u> turn, completely separate pump from adapter.

(NOTE: Quick action is necessary to close the drop valve. If movable handle has moved 1/4" or more away from red washer, either the radiator cap is not holding pressure or the pump was not separated quickly enough from the adapter.)

Pump up system again to 16 psi and quickly and completely separate pump from adapter. If handle still moves 1/4" or more, check radiator cap for pressure, as indicated in Step 17. Cap should hold 12 pounds minimum pressure.

14. Make sure red washer is seated against movable handle. After 5 minutes, wiggle hose and note position of movable handle relative to red washer.

15. If handle has not moved more than 1/4 inch in 5 minutes, cooling system is holding sufficient pressure Release system pressure slowly to prevent entry of air into cooling system. Test is complete.

16. If handle has moved more than 1/4 inch, inspect for leaks. Repair as required and repeat Steps 11-15.

17. If leak is not obvious, repeat Steps 3 through 6 and Step 12. Remove adapter from hose on reservoir cap. Insert end of hose in a glass of water below liquid level and watch for bubbles. Presence of bubbles indicates a leaking relief valve or drop valve. Inspect relief valve gasket on cap and inner sealing surface of filler neck for damage or foreign debris.

Cap relief valve may be pressure checked by replacing end of Adapter, J-23699, with radiator cap and pumping pressure tester slowly to obtain minimum holding pressure. A reading of less than 12 pounds indicates a defective cap. If cap is defective, replace cap and repeat Steps 11-15.

18. Remove adapter from bottom of reservoir cap hose if not done in Step 17. Install reservoir cap and remove Hose Gage, J-23636.

2. Thermostat Test

The thermostat may be checked by suspending it, with the thermostat heat control unit <u>down</u>, in a small pan of ethylene glycol coolant containing a thermometer. Neither the thermostat nor the thermometer should rest on the bottom of the pan because of the uneven concentration of heat at this point when the pan is heated. The thermostat valve should start to open at a temperature between 177°F and 182°F. When the coolant reaches a temperature of 202°F, the valve should be fully open (approximately 1/4 inch).

3. Testing Coolant Solutions

A hydrometer test will indicate whether ethylene glycol or water or both should be added to maintain the desired freezing point of the solution. The freezing point of the solution should give protection to at least -40°F, regardless of climatic conditions. This is necessary to provide adequate corrosion protection.

Some devices used for testing solutions will indicate the correct freezing point only when tested at a specific temperature. Other testers provide thermometers and tables indicating freezing points corresponding to readings made at various temperatures. Disregarding the temperature of the solution when testing may cause an error as large as 30°F in determining the freezing point.

SERVICE INFORMATION

4. Cooling System Preventive Maintenance

Every 12 months or 12,000 miles (whichever occurs first) inspect cooling system, wash radiator cap and filler neck, and pressure test cap and system. Tighten hose clamps as necessary and clean exterior of radiator core.

Regardless of climate, the cooling system should be drained, flushed with water only, and refilled every 24 months or 24,000 miles, whichever occurs first, with a 50-50 mixture of water and an ethylene glycol base coolant to protect the engine to at least -40°F. In addition, replace all hoses at these 24 month/24,000 mile intervals. These measures are necessary to retard corrosion, rust, and scale; keep water passages open; and seal against internal or external leakage.

(NOTE: Supplemental inhibitors or additives claiming to provide increased cooling capability that have not been specifically approved by GM are not recommended for addition to the cooling system. These additives may be detrimental to the efficient operation of the system, and they represent an unnecessary operating expense.)

Check coolant level in reservoir at each engine oil change. The coolant reservoir is marked "FULL" and "ADD", Fig. 6-5. These marks are approximately two quarts apart so that one quart of ethylene glycol and one quart of water can be added. The reserve above the full mark is to allow for expansion while parked after hot running. The coolant level should be between the "FULL" and "ADD" marks at normal operating temperature. The level may be observed below the "ADD" mark when the system cools below operating temperature.

5. Cooling System Flushing Procedure

1. Drain coolant from cooling system by opening radiator drain cock and removing two drain plugs from cylinder block. If coolant side of radiator cap is rusty, drain system twice.

2. After drain points have been closed, refill system with fresh water only and install radiator cap. Set defrost lever to "DEF" position and turn temperature to 85°. This opens the water control valve and allows the water to pass through the heater core.

(NOTE: On Fleetwood Seventy-Five Sedans and Limousines, also turn rear heater system on and rotate temperature dial to 85°.)

3. Run engine at medium speed for one-half hour at a temperature as hot as possible without boiling. Cover one-half the radiator if necessary.

4. Inspect the following points in the cooling system:

a. Radiator core for leaks.

b. Radiator air passages for plugging caused by bugs, leaves, etc.

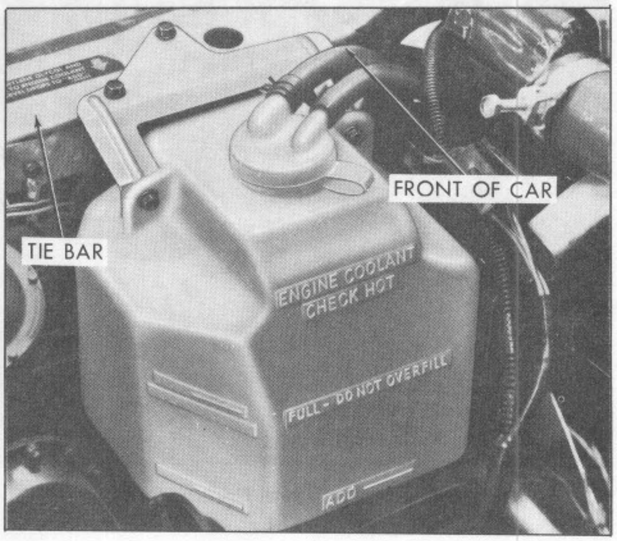


Fig. 6-5 Coolant Reservoir

c. Condition and tension of drive belts, as described in Note 10.

d. Condition of hoses and tightness of clamps.

5. Drain system by repeating Step 1. If flush water has a rust color, repeat procedure.

6. Add equal amounts of ethylene glycol base coolant and water to protect engine to at least -40°F.

(NOTE: Supplemental inhibitors or additives claiming to provide increased cooling capability that have not been specifically approved by GM are not recommended for addition to the cooling system. These additives may be detrimental to the efficient operation of the system, and they represent an unnecessary operating expense.)

7. With the radiator cap removed and heater controls on maximum as outlined in Step 2, run engine with throttle set on fast idle cam for 10 minutes. Add coolant until the radiator is completely full and tighten radiator cap before stopping engine.

8. Check coolant level in the reservoir and add coolant as necessary to bring level up to the "FULL" mark.

9. Deterioration of the hoses in the engine compartment takes place over a period of time due to the exposure to high temperatures in this environment. To protect the engine from damage due to coolant loss, the hoses and clamps in the engine cooling and heater systems should be replaced after two years of service or after 24,000 miles, whichever occurs first.

6. Thermostat

a. Removal

1. Drain radiator until coolant level is below level of thermostat housing.

2. Disconnect upper radiator hose at thermostat housing.

3. Remove two screws securing thermostat housing to cylinder block and remove housing. Discard gasket.
4. Remove thermostat from cylinder block.

b. Installation

1. Install thermostat in opening at top of cylinder block with valve up.
2. Position a new gasket coated with gasket cement on cylinder block.
3. Install thermostat housing on cylinder block and secure with two screws. Tighten screws to 10 foot-pounds.
4. Connect upper radiator hose to thermostat housing.
5. Fill cooling system to proper level.

7. Fan Blade (Flexible Fan)

a. Removal

1. Remove six screws securing radiator cover and one screw securing upper radiator hose brace to cover and remove cover.
2. Unthread four screws holding fan and spacer to water pump hub. Screws cannot be removed due to radiator clearance. Screws are most easily loosened by loosening the generator and rotating the fan to put each screw at the top in turn.
3. Move entire fan assembly (fan, spacer, screws) away from hub to a point near the power steering pump and remove the screws and spacer now that space permits.
4. Remove fan by sliding between cradle and radiator.

b. Installation

WARNING: IT IS ESSENTIAL THAT FAN ASSEMBLIES REMAIN IN PROPER BALANCE AND PROPER BALANCE CANNOT BE ASSURED ONCE A FAN ASSEMBLY HAS BEEN BENT OR DAMAGED. A FAN ASSEMBLY THAT IS NOT IN PROPER BLANCE COULD FAIL AND FLY APART DURING SUBSEQUENT USE CREATING AN EXTREMELY DANGEROUS CONDITION.

IF A FAN BLADE IS BENT OR DAMAGED IN ANY WAY, NO ATTEMPT SHOULD BE MADE TO REPAIR AND REUSE THE DAMAGED PART. A BENT OR DAMAGED FAN ASSEMBLY SHOULD ALWAYS BE REPLACED WITH A NEW FAN ASSEMBLY.

1. Slide fan between radiator cradle and radiator and temporarily position near power steering pump.
2. Insert four screws through fan and spacer.
3. Make sure mounting holes in water pump pulley line up with threaded holes in water pump hub.
4. Position fan assembly to water pump hub and tighten screws to 18 foot-pounds.
5. Position radiator cover and secure with six screws.
6. Secure upper radiator hose to radiator cover with one screw.

8. Fan Assembly (Clutch Fan)

a. Removal

1. Remove six screws securing radiator cover and one screw securing radiator hose brace to cover. Remove cover.
2. Remove four nuts securing clutch hub to fan hub.
3. Remove fan and clutch by pulling forward off studs and then straight up.

b. Installation

NOTE: OBSERVE WARNING IN NOTE 7b.

1. Secure fan blade to clutch with four screws. Tighten screws to 18 foot-pounds.
2. Slide fan and clutch into position and install four attaching nuts. Tighten nuts to 18 foot-pounds.
3. Position radiator cover and secure with six screws.
4. Secure upper radiator hose to radiator cover with one screw.

9. Water Pump Overhaul

(NOTE: Some water pumps may have a greenish coolant stain at the vent hole below the shaft. This is a normal condition. The water pump should not be serviced unless it is obviously leaking with the engine running and under pressure.)

a. Removal

1. Disconnect negative battery cable.
2. Drain radiator.
3. Remove fan assembly as described in Notes 7a or 8a.
4. Loosen generator mounting screws and remove generator belt.
5. Loosen A.I.R. pump mounting screws and remove drive belt.
6. Loosen power steering pump mounting screws and remove power steering pump belt.

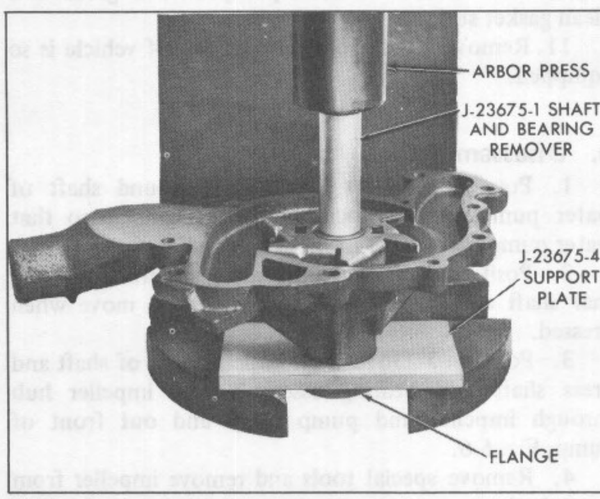


Fig. 6-6 Disassembling Water Pump

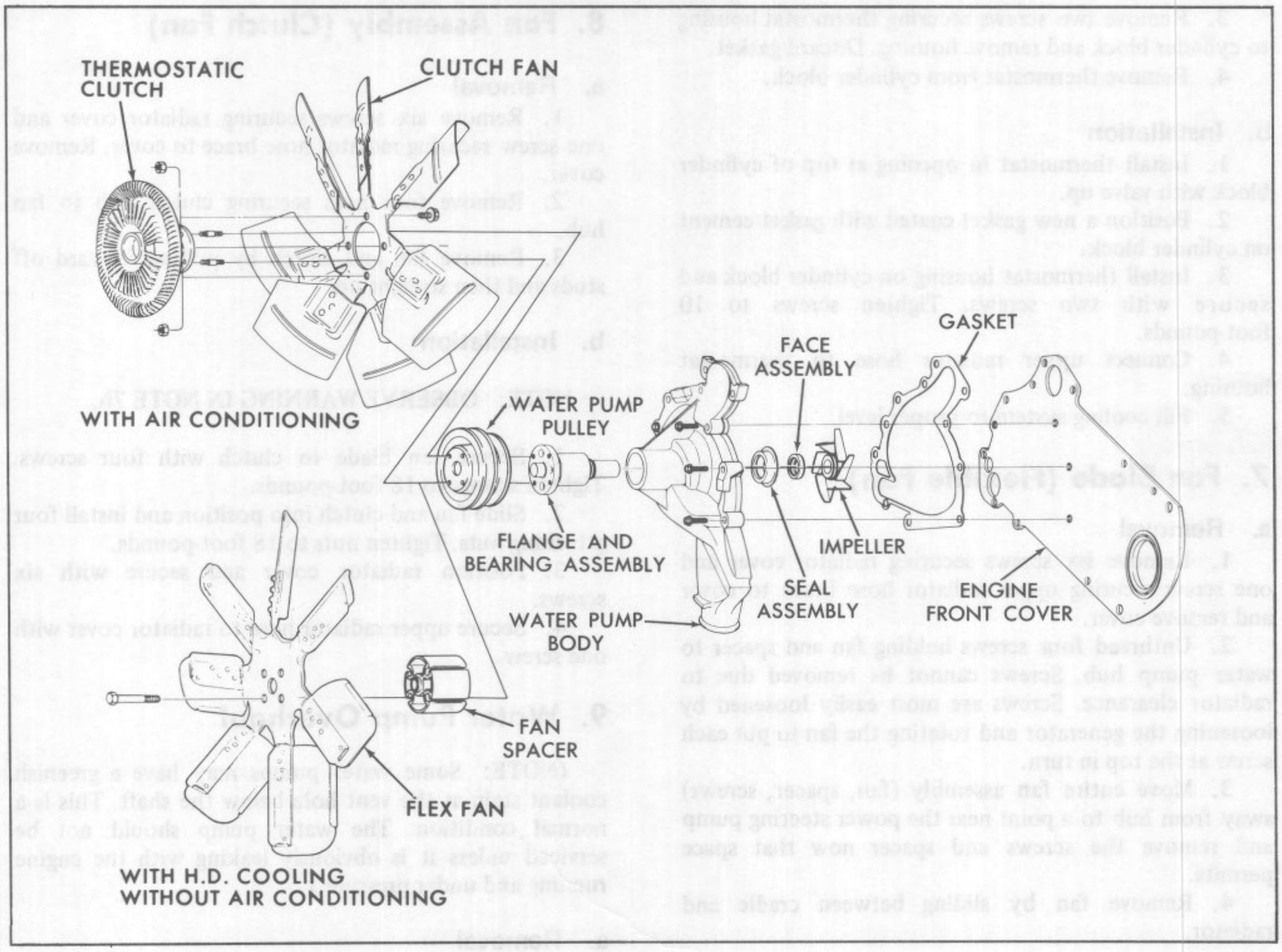


Fig. 6-7 Water Pump Disassembled

7. Remove water pump pulley from shaft.

8. Disconnect water inlet hose from water pump.

9. Loosen four screws securing crankshaft pulley to hub approximately 1/2 way and move pulley out slightly.

10. Remove 11 screws securing water pump to engine front cover and remove pump. Discard gasket and clean gasket surfaces.

11. Remove studs from pump flange if vehicle is so equipped.

b. Disassembly

1. Position Support, J-23675-4, around shaft of water pump between pump body and flange so that water pump casting fits in slight recess, Fig. 6-6.

2. Position pump impeller-side-up in arbor press so that shaft and bearing assembly is free to move when pressed.

3. Position J-23675-1 on impeller side of shaft and press shaft and bearing assembly and impeller hub through impeller and pump body and out front of pump, Fig. 6-6.

4. Remove special tools and remove impeller from pump body.

5. Discard all parts except pump body, Fig. 6-7.

c. Assembly

1 Position Bearing Locator, J-23675-3, into rear of pump and place pump, face up, in arbor press, Fig. 6-8.

(NOTE: Locator, J-23675-3, determines depth that bearing is installed in water pump body. The body rests on the lower step and bearing outer race bottoms against the upper step upon installation of the bearing.)

2. Using Shaft and Bearing Installer, J-23675-2, press shaft and bearing into pump until bearing outer race bottoms on Locator, J-23675-3, Fig. 6-8.

(NOTE: If a hydraulic press is used, care should be exercised not to exert excessive pressure on the pins of J-23675-2. If available, a press without hydraulic assist is best used for this job.)

Installer, J-23675-2, acts only as an installer, not as a gage. The notches on the pins of J-23675-2 accommodate production variations of the flange and bearing assembly and water pump body. On a few pumps, outer race of bearing may be below water pump body. However, the low steps of J-23675-2 will never touch the pump body when correctly installed.

3. Position Support, J-23675-4, between water pump body and flange, so that water pump casting fits in slight recess, Fig. 6-9.

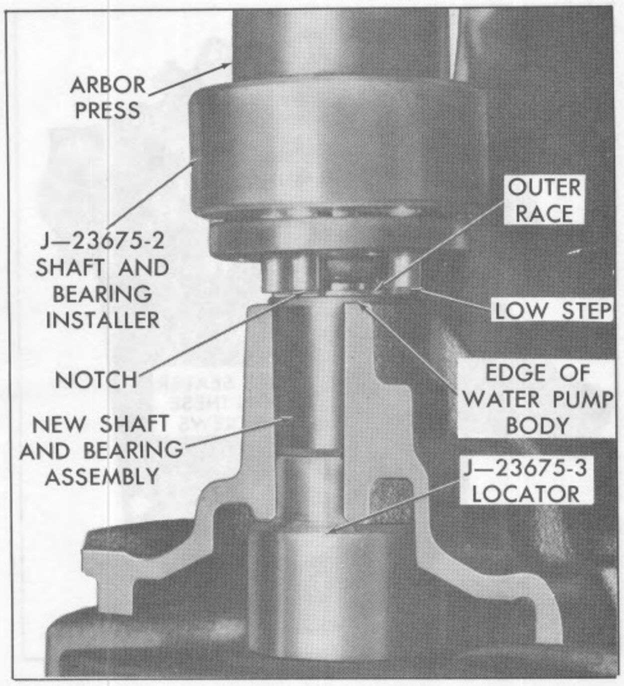


Fig. 6-8 Installing Shaft and Bearings

4. Position new seal assembly over shaft with spring end up and press into position using Seal Installer, J-8999-9, Fig. 6-9.

(NOTE: Support Plate, J-23675-4, supports the pump body as the seal assembly is seated against the body. This arrangement prevents an accidental dislocation of the bearing in its relation to the pump body.)

5. Dip ceramic seal in ethylene glycol before installing over shaft. Install ceramic seal and drive rubber over shaft with ceramic side down.

6. Position Bearing Installer, J-23675-2, with pins down and not supporting assembly into cut out section of Support Plate, J-23675-4, and position shaft on flange into hole in J-23675-2, Fig. 6-10.

7. Position impeller vanes down over shaft and exactly center recess of J-23675-1 on impeller hub. Fig. 6-10. Press impeller into position until tool bottoms on shaft.

(NOTE: J-23675-1 positions the impeller so the shaft is .010"0.20" above impeller hub. This aligns the impeller so the blades will not strike the engine front cover. When installing the impeller, shaft is supported on its ends by J-23675-1 and J-23675-2. This arrangement prevents an accidental dislocation of the bearing in its relation to the pump body.)

8. Check to see that impeller does not strike engine front cover upon installation. This may be done by placing a straight edge across the body and rotating the impeller. Shaft and impeller blades should clear the straight edge.

9. If blades clear, install pump on car. If the blades do not clear, the following corrective action may be taken.

10. Repeat Steps 6 and 7 and check for impeller clearance. Also, if blades do not stick out past the body excessively, the engine front cover gasket may provide the necessary clearance.

11. If Step 10 does not correct problem, an attempt may be made to relocate the impeller hub. Position Bearing Installer, J-23675-2, with pins down and not

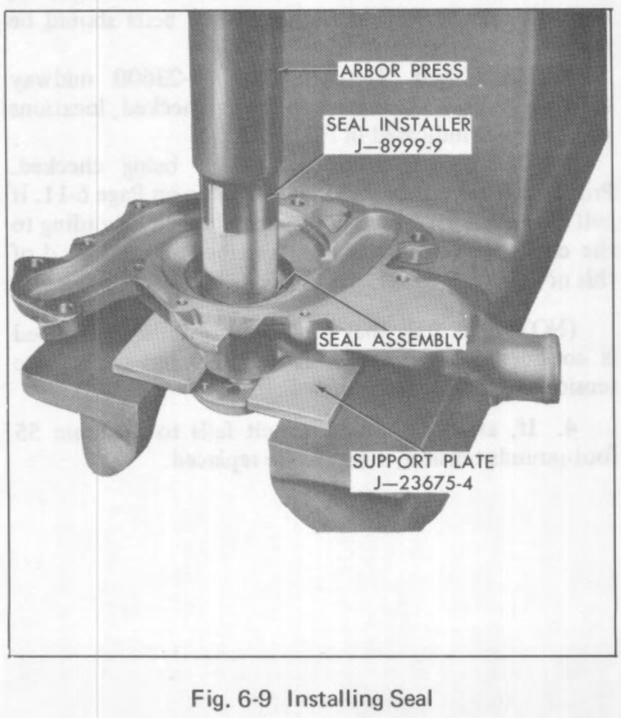


Fig. 6-9 Installing Seal

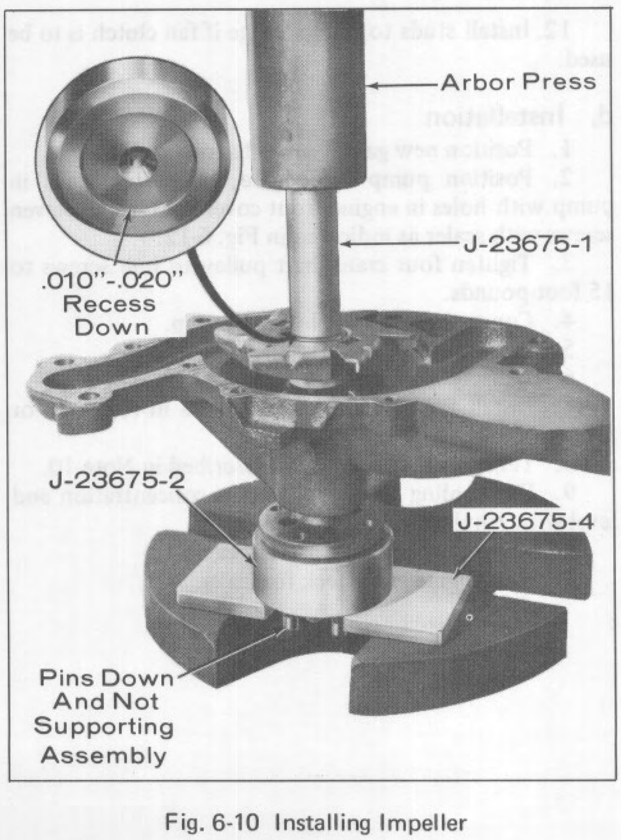


Fig. 6-10 Installing Impeller

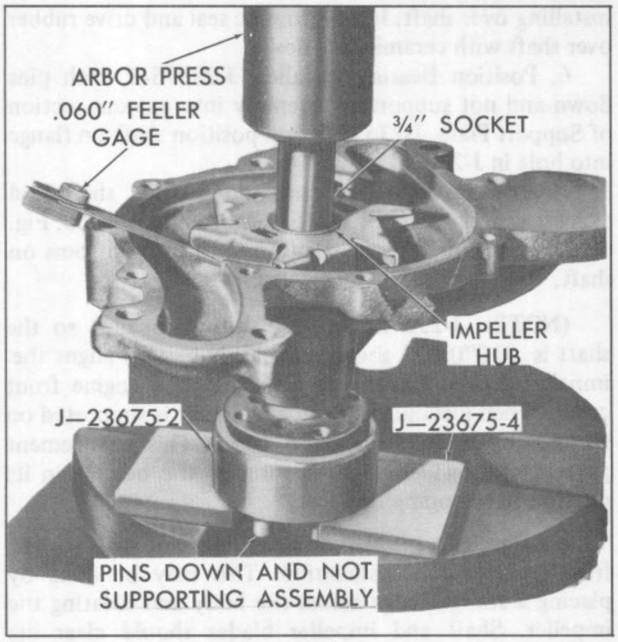


Fig. 6-11 Gaging Impeller

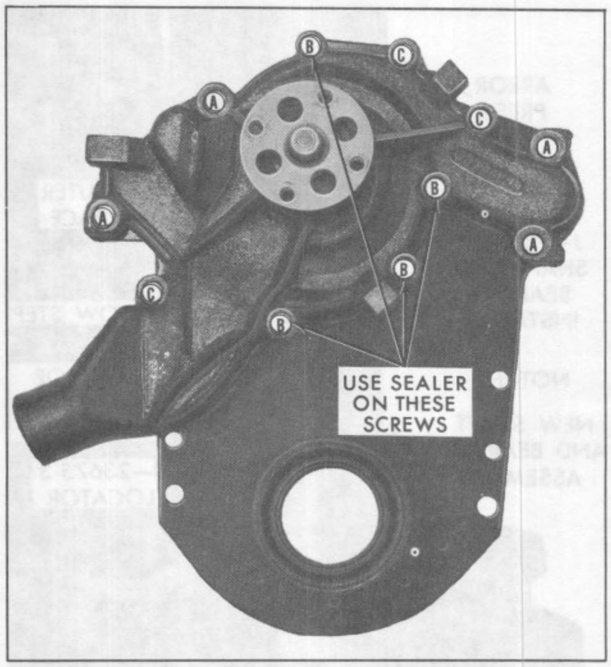
supporting assembly, into cut out section of Support Plate, J-23675-4. Position shaft on flange into hole in J-23675-2, Fig. 6-11. Center a 3/4" socket on impeller hub and insert .060" feeler gage between pump body and impeller blade. Carefully press impeller hub until correct clearance is obtained. Specification between body and blade is .030" to .060".

CAUTION: Do not press too far or rebuilt pump may be damaged.

12. Install studs to pump flange if fan clutch is to be used.

d. Installation

1. Position new gasket on water pump flange.
2. Position pump on engine, lining up holes in pump with holes in engine front cover, and install eleven screws with sealer as indicated in Fig. 6-12.
3. Tighten four crankshaft pulley to hub screws to 15 foot-pounds.
4. Connect water inlet hose to pump.
5. Position water pump pulley on pump.
6. Loosely install all drive belts.
7. Install fan assembly as described in Notes 7b or 8b.
8. Tension all drive belts as described in Note 10.
9. Fill cooling system to proper concentration and level with ethylene glycol base coolant.
10. Reconnect negative battery cable.
11. Run engine and check for leaks.



Key	No.	Size	Torque
A	(4)	3/8 - 16 x 1-3/8	22 foot-pounds
B	(4)	1/4 - 20 x 1-1/8	70 inch-pounds
C	(3)	5/16 - 18 x 1-1/4	15 foot-pounds

Fig. 6-12 Water Pump Assembly Attaching Screws

10. Belt Adjustments

a. Checking Drive Belts

1. Drive belts should be checked for signs of unusual wear, cuts, and fraying. Worn belts should be replaced.

2. Place Belt Tension Gage, J-23600 midway between pulleys on drive belt being checked, locations A, B, C, or D indicated in Fig. 6-13.

3. Check gage reading for belt being checked. Proper belt tension is shown in the table on Page 6-11. If belt tension is incorrect, adjust specific belt according to the corresponding procedure described in b, c, or d of this note.

(NOTE: A belt that has been previously tensioned is considered a used belt. A belt that has never been tensioned is considered a new belt.)

4. If, after tensioning, a belt fails to maintain 55 foot-pounds tension, it should be replaced.

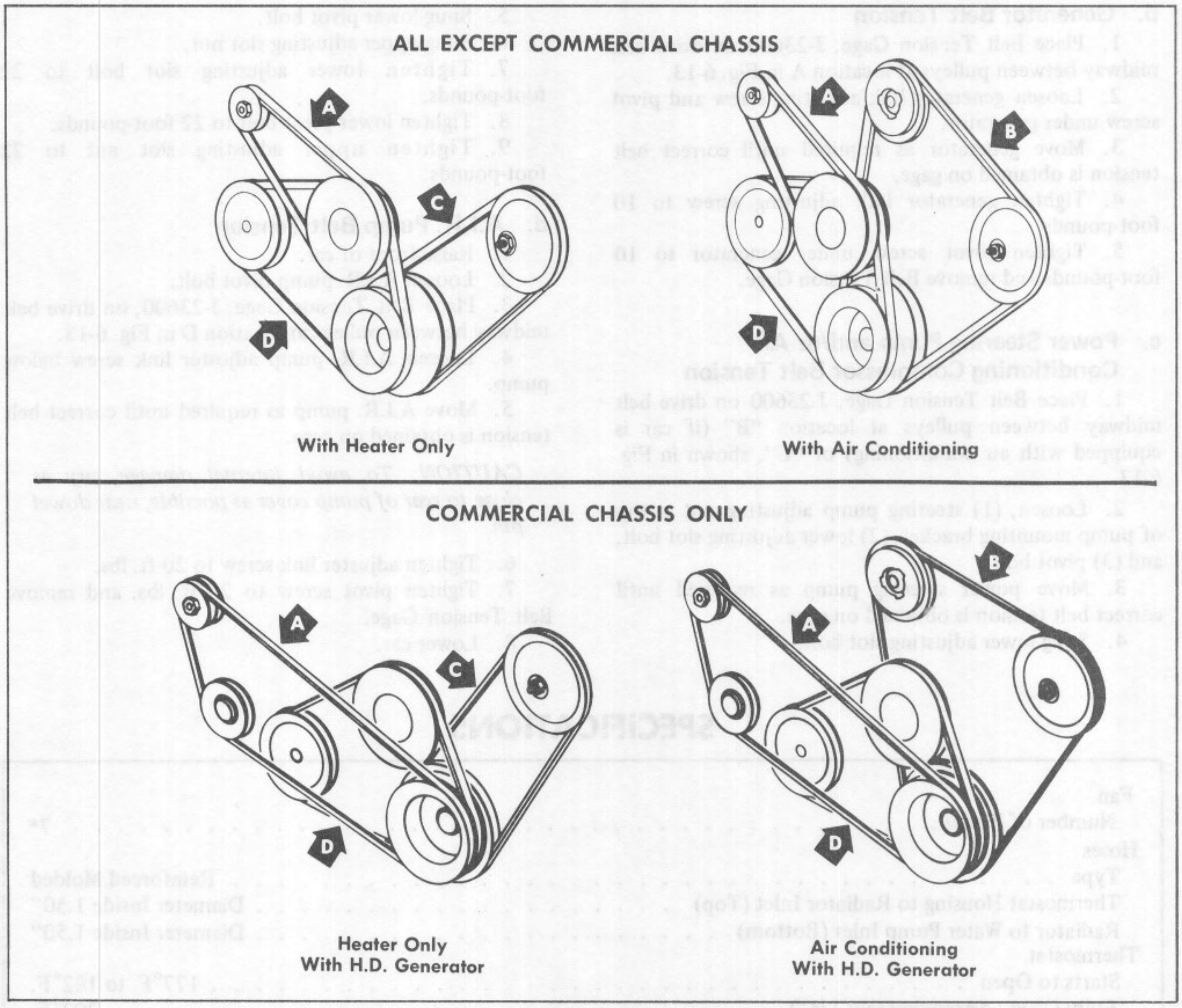


Fig. 6-13 Belt Tensioning

Belts	Type	Tension		Width	Length
		New	Used		
A.I.R. Pump	36° Wedge	170 Lbs.	120 Lbs.	.500″	46.50″
Generator					
42 & 63 AMP	36° Wedge	100 Lbs.	70 Lbs.	.470″	38.00″
80 AMP	36° Wedge	100 Lbs.	70 Lbs.	.470″	39.00″
145 AMP	36° Wedge	170 Lbs.	120 Lbs.	.500″	57.50″
Power Steering Pump and Air Conditioning Compressor	36° Wedge	170 Lbs.	120 Lbs.	.500″	60.50″
Power Steering Pump (Commercial Chassis without Air Conditioning)	36° Wedge	170 Lbs.	120 Lbs.	.500″	48.50″

b. Generator Belt Tension

1. Place Belt Tension Gage, J-23600 on drive belt midway between pulleys at location A in Fig. 6-13.
2. Loosen generator link adjusting screw and pivot screw under generator.
3. Move generator as required until correct belt tension is obtained on gage.
4. Tighten generator link adjusting screw to 10 foot-pounds.
5. Tighten pivot screw under generator to 10 foot-pounds and remove Belt Tension Gage.

c. Power Steering Pump and/or Air Conditioning Compressor Belt Tension

1. Place Belt Tension Gage, J-23600 on drive belt midway between pulleys at location "B" (if car is equipped with air conditioning) or "C", shown in Fig. 6-13.
2. Loosen, (1) steering pump adjusting nut at top of pump mounting bracket, (2) lower adjusting slot bolt, and (3) pivot bolt.
3. Move power steering pump as required until correct belt tension is obtained on gage.
4. Snug lower adjusting slot bolt.
5. Snug lower pivot bolt.
6. Snug upper adjusting slot nut.
7. Tighten lower adjusting slot bolt to 22 foot-pounds.
8. Tighten lower pivot bolt to 22 foot-pounds.
9. Tighten upper adjusting slot nut to 22 foot-pounds.

d. A.I.R. Pump Belt Tension

1. Raise front of car.
2. Loosen A.I.R. pump pivot bolt.
3. Place Belt Tension Gage, J-23600, on drive belt midway between pulleys at location D in Fig. 6-13.
4. Loosen A.I.R. pump adjuster link screw below pump.
5. Move A.I.R. pump as required until correct belt tension is obtained on gage.

CAUTION: To avoid internal damage, pry as close to rear of pump cover as possible, near dowel pin.

6. Tighten adjuster link screw to 20 ft. lbs.
7. Tighten pivot screw to 25 ft. lbs. and remove Belt Tension Gage.
8. Lower car.

SPECIFICATIONS

Fan	
Number of Blades	7*
Hoses	
Type	Reinforced Molded
Thermostat Housing to Radiator Inlet (Top)	Diameter Inside 1.50"
Radiator to Water Pump Inlet (Bottom)	Diameter Inside 1.50"
Thermostat	
Starts to Open	177°F. to 182°F.
Fully Open (Approximately 1/4")	202°F.
Drive Belt Ratios	
Water Pump	1.24 to 1
Generator–Except Heavy Duty	3.21 to 1
Generator–Heavy Duty	2.28 to 1
Power Steering Pump	1.26 to 1
Air Conditioning Compressor	1.48 to 1
A.I.R. Pump	1.20 to 1
Capacity of System	
with Heater	21.3 Qts.
with Air Conditioning	23.8 Qts.
with Heater Only and H.D. Cooling	23.8 Qts.
Seventy-Five Series	26.8 Qts.
Area of Core	480 Sq. In.
Core Depth	
Non-Air Conditioned Car	1.26 In.
Air Conditioned Cars	1.98 In.
with H.D. Cooling or Trailer Towing Package	2.70 In.
Core Center Constant	
Except Eldorado w/Air Conditioning	.16 In.
Eldorado w/Air Conditioning, All Cars w/H.D. Cooling or Trailer Towing Package	.14 In.
Tubing Spacing	.55 In
Radiator Cap Pressure	13.5 to 16.5 psi

*With Fan Clutch on Air Conditioned Cars

TORQUE SPECIFICATIONS

Material Number	Application	Size	Torque
280M	Fan Blade Assembly Mounting Screw/Nut	5/16-24	18 Ft. Lbs.
1010	Heater Hose Clamp	10-24	13 In. Lbs.
280M	Thermostat Housing Screw	5/16-18	10 Ft. Lbs.
260M	*Water Pump to Cylinder Block Screw	3/8-16	22 Ft. Lbs.
260M	*Water Pump to Cylinder Block	5/16-18	15 Ft. Lbs.
260M	*Water Pump to Front Cover Screw	1/4-20	70 In. Lbs.
	*Refer to Fig. 6-12 for proper screw location.		

NOTE: Refer to back of manual, Page 16-1 for nut and bolt markings and Steel Classifications.

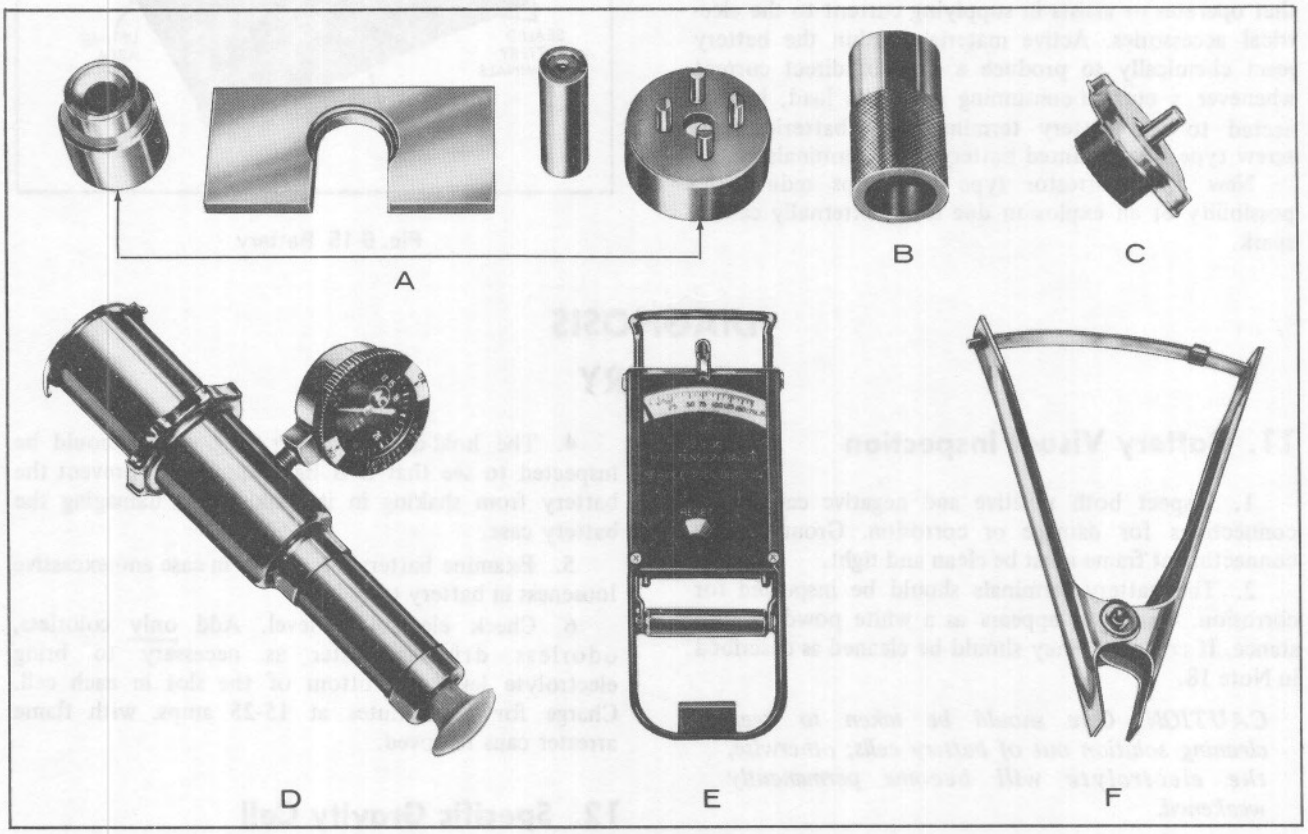


Fig. 6-14 Special Tools

KEY	TOOL NUMBER	NAME
A	J-23675*	Water Pump Overhaul Kit
B	J-8999-9	Seal Installer
C	J-23699	Pressure Tester Adapter
D	J-24460	Pressure Tester
E	J-23600	Belt Tension Gage
F	J-23636	Hose Gage

*Water Pump Overhaul Kit, J-23675, consists of:

One J-23675-1 Shaft and Bearing Assembly Remover

One J-23675-2 Shaft and Bearing Assembly Installer

One J-23675-3 Shaft and Bearing Locator

One J-23675-4 Support Plate

THEORY OF OPERATION

BATTERY

Battery

A 12-volt negative-ground electrical system is used on all Cadillac vehicles. A 12-volt secondary solid top battery, Fig. 6-15, is mounted in a tray on the right side of the radiator cradle assembly. The retainer grooves in the front and rear sides of the battery, Fig. 6-15 and Fig. 6-16, secure the battery to the tray by means of a locking rod. The battery has a cranking capacity of 3600 watts at 0°F.

Battery removal is aided by the use of hand holds at each end, Fig. 6-15.

The lead acid battery is a source of electrical energy that operates or assists in supplying current to the electrical accessories. Active materials within the battery react chemically to produce a flow of direct current whenever a current-consuming device, a load, is connected to the battery terminals. All batteries have screw type side mounted battery cable terminals.

New flame arrestor type vent caps reduce the possibility of an explosion due to an externally caused spark.

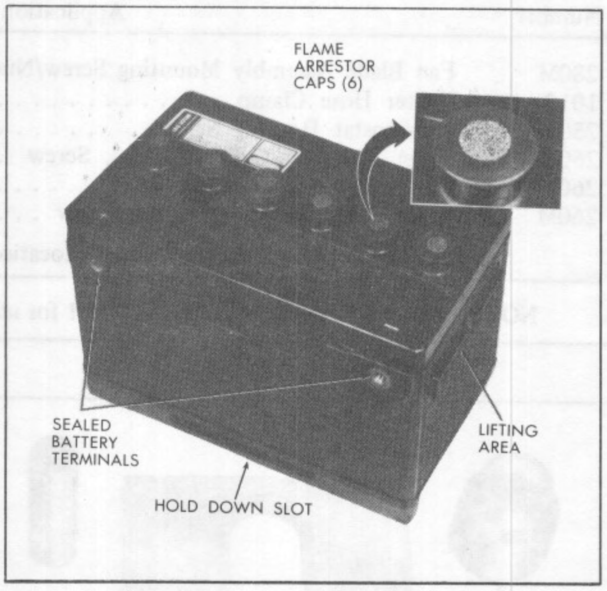


Fig. 6-15 Battery

DIAGNOSIS

BATTERY

11. Battery Visual Inspection

1. Inspect both positive and negative cables and connections for damage or corrosion. Ground cable connection at frame must be clean and tight.

2. The battery terminals should be inspected for corrosion. Corrosion appears as a white powdery substance. If corroded, they should be cleaned as described in Note 18.

CAUTION: Care should be taken to keep cleaning solution out of battery cells; otherwise, the electrolyte will become permanently weakened.

3. Inspect metal carrier for corrosion. If corrosion exists, it will be necessary to remove retainer and battery from car and pour warm soda or ammonia water over corroded areas to loosen the corrosion so that it can be brushed off and flushed away.

4. The hold-down retainer (Fig. 6-16) should be inspected to see that it is tight enough to prevent the battery from shaking in its holder and damaging the battery case.

5. Examine battery for cracks in case and excessive looseness in battery tray.

6. Check electrolyte level. Add only colorless, odorless drinking water as necessary to bring electrolyte level to bottom of the slot in each cell. Charge for 15 minutes at 15-25 amps. with flame arrester caps removed.

12. Specific Gravity Cell Comparison Test

1. Measure the specific gravity of each cell in the battery and the temperature of one of the center cells. Interpret readings as shown below.

Specific Gravity Difference Between Highest and Lowest Cells	Specific Gravity of Lowest Cell (Temp. Corrected)	Interpretation
Less than 50 points	More than 1.100	Proceed to "421" test (Note 12)
Less than 50 points	Less than 1.100	Proceed to load test (Note 13)
50 points or more		Defective battery – Replace

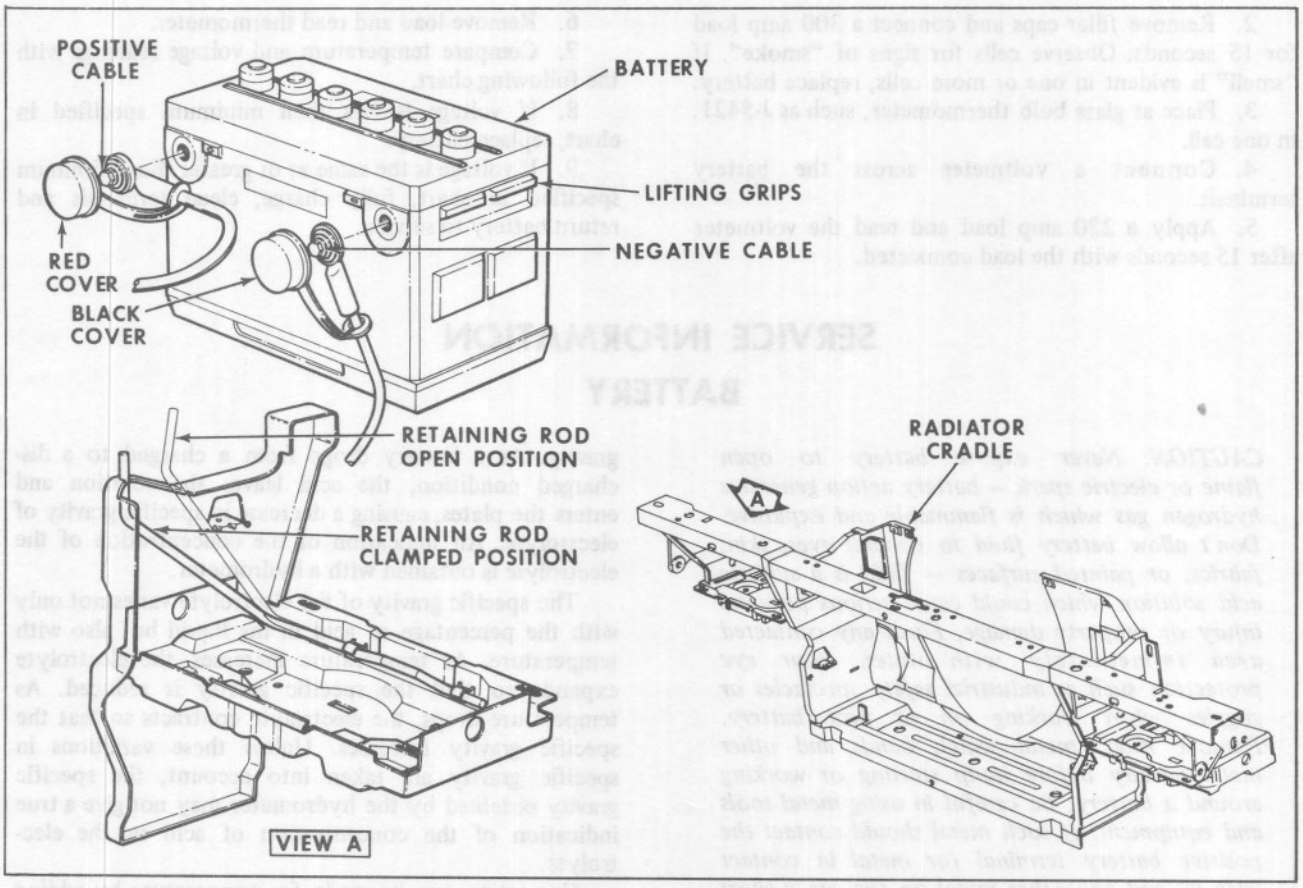


Fig. 6-16 Battery Retainer

2. When the specific gravity of the electrolyte falls within the 50 point variation between cells and the 1.230 to 1.310 specific gravity range, the battery is ready for use.

3. If any cell reads less than 1.100 and the battery has been in service more than three months, it should be replaced.

4. If any cell reads above 1.310, the battery may be returned to service. However, specific gravities above 1.310 are harmful to the battery and will cause an early failure. Such high readings are caused by the improper addition of electrolyte. Adjusting the specific gravity by pouring out the old solution and replacing it with electrolyte of the correct specific gravity will not correct the damage that has been done.

13. Testing Battery Condition

A battery testing instrument, designated a "421 Tester", is recommended to test the solid top batteries of all Cadillac vehicles. These "421" Testers, manufactured by several test equipment companies, will quickly determine the condition of a battery relative to state of charge and ability to provide satisfactory performance.

(NOTE: Do not charge batteries prior to making test. Be certain to obtain clean and tight connections before performing the "421" test.)

1. Perform "421" battery test following instructions on your particular test instrument.

2. Batteries designated Bad by "421" tester should be replaced.

3. Batteries designated Good by "421" tester may be returned to service if there is no owner complaint or other indication of poor performance.

4. Batteries designated Good by "421" tester, but are questionable in service because of owner complaint or age of battery, should be further tested as outlined in Note 14.

14. Battery Load Test

1. Charge battery, if necessary, until all cells are at least 1.200 specific gravity. If this is not possible in all cells, replace battery.

Temperature °F	Minimum Voltage
70° or greater	9.6
60° to 69°	9.5
50° to 59°	9.4
40° to 49°	9.3
30° to 39°	9.1
20° to 29°	8.9
10° to 19°	8.7
0° to 9°	8.5

2. Remove filler caps and connect a 300 amp load for 15 seconds. Observe cells for signs of "smoke". If "smell" is evident in one or more cells, replace battery.

3. Place at glass bulb thermometer, such as J-5421, in one cell.

4. Connect a voltmeter across the battery terminals.

5. Apply a 220 amp load and read the voltmeter after 15 seconds with the load connected.

6. Remove load and read thermometer.

7. Compare temperature and voltage readings with the following chart.

8. If voltage is less than minimum specified in chart, replace battery.

9. If voltage is the same as or greater than minimum specified in chart, fully charge, clean terminals and return battery to service.

SERVICE INFORMATION

BATTERY

CAUTION: Never expose battery to open flame or electric spark – battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact eyes, skin, fabrics, or painted surfaces – fluid is a sulfuric acid solution which could cause serious personal injury or property damage. Flush any contacted area immediately with water. Wear eye protection such as industrial safety spectacles or goggles when working on or near battery. Remove rings, metal watch bands and other metal jewelry before jump starting or working around a battery. Be careful in using metal tools and equipment. If such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the car, a short circuit may occur which could cause personal injury. Batteries and battery acid should always be kept out of reach of children.

(NOTE: When reconnecting battery terminals on a Theft Deterrant System equipped car, expect the car horns and lights to operate as they do when the alarm is activated. This is normal and the alarm may be turned off by turning ignition key to accessory or on position.)

15. Battery Filling Instructions

The battery electrolyte level should be checked at every engine oil change. In warm weather, a check should be made at two-week intervals. Flame arrestor vent caps are used on all six cells and must be removed when checking fluid level. For replacement use only flame arrestor type caps. All cells must be filled to the bottom of each slot with colorless, odorless drinking water.

CAUTION: Do not overfill battery or add any substance to fluid except colorless, odorless drinking water.

16. Use of Hydrometer

The hydrometer measures the percentage of sulphuric acid in the battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, the acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. An indication of the concentration of the electrolyte is obtained with a hydrometer.

The specific gravity of the electrolyte varies not only with the percentage of acid in the liquid but also with temperature. As temperature increases, the electrolyte expands so that the specific gravity is reduced. As temperature drops, the electrolyte contracts so that the specific gravity increases. Unless these variations in specific gravity are taken into account, the specific gravity obtained by the hydrometer may not give a true indication of the concentration of acid in the electrolyte.

Correction can be made for temperature by adding .004, usually referred to as four "points of gravity", to the hydrometer reading for every 10°F. that the elec-

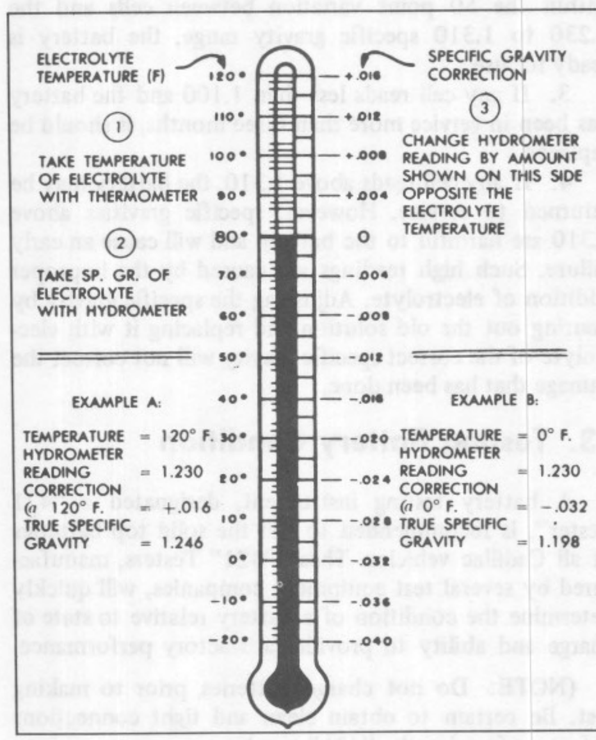


Fig. 6-17 Specific Gravity Temperature Correction Scale

trolyte is above 80°F. or subtracting .004 for every 10°F. that electrolyte is below 80°F. Fig. 6-17 shows the exact correction figure to use for any temperature above or below 80°F., the three steps used in obtaining the corrected or true specific gravity, and two examples showing how it is determined.

If the electrolyte temperature is not too far from the 80°F. standard, or if only an approximate idea of specific gravity reading is required, it will not be necessary to make the temperature correction. Hydrometers are available which have a built-in thermometer and temperature correction scale similar to Fig. 6-17. This type of hydrometer simplifies obtaining a true specific gravity reading.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean, inside and out to insure an accurate reading.
2. Hydrometer readings must never be taken immediately after water has been added. The water must be thoroughly mixed with the electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer draw liquid into it several times to insure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard the curvature where the liquid rises against float stem due to surface tension.

CAUTION: Avoid dropping battery fluid on car or clothing as it is extremely corrosive. Any fluid that drops should be washed off immediately with baking soda solution.

17. Causes of Low Battery Conditions

Common causes of low battery conditions other than those due to a defective battery are listed below, and should be investigated when there are indications that the car has a consistently low battery.

1. Excessive use of accessories with the engine not running.
2. Leaving lights on or doors open.
3. Improper installation of accessories.
4. Generator belt loose.
5. Self-discharge resulting from a dirty battery case.
6. Loose battery cables.
7. Low generator output, which may be checked and corrected as explained in Note 45.
8. High resistance in charging circuits.

18. Care of Batteries Not in Use

Batteries in cars that are being stored require special care to prevent plate sulphation or other deterioration due to chemical action.

Before a wet charged battery is stored, an inspection should be made to see that it is filled to the proper level and that it is fully charged (1.250-1.280).

Wet batteries in storage should be checked every 30 days and given a boost charge of 25 per cent of the ampere hour rating of the battery at a rate of 5 amperes.

19. Battery Cable Service

Improperly torqued side terminal battery cables can cause high resistances to develop which may lead to hard starting conditions. The following procedure is recommended should this condition be encountered.

1. Remove negative battery cable.
2. Clean threads and end of cable screw with a wire brush. Cleaning of the screw end is particularly important.
3. Clean the internal threads in the battery case and the end of the hole where the cable screw makes contact. A 3/8-16 bottoming tap can be used to clean the threads, however, extreme caution should be exercised to see that the 70 inch-pound torque limit is not exceeded.
4. Repeat Steps 1 thru 3 for the positive cable.
5. Install positive cable and torque to 70 inch-pounds. Install protective cover.
6. Install negative cable and torque to 70 inch-pounds. Install protective cover.

BATTERY CHARGING CHART

Condition	Rate	Time
Slow Charge	4 Amps	24 hours
Fast Charge	40-50 Amps	1 1/2 hours
Emergency Boost Charge	40-50 Amps	30 minutes
*Dry Battery Warm-up Charge	15 Amps	10 minutes

*Required for dry charged batteries being activated with electrolyte at a temperature below 60°F or batteries which are to go into immediate operation in below freezing temperatures.

THEORY OF OPERATION
STARTER

Starter

The starter Motor Fig. 6-18 is mounted on the right rear side of the engine. The starter motor has four pole shoes and a two series field. The drive end housing encloses the entire shift lever mechanism. An over-running clutch drive is used to engage the cranking motor pinion with the engine flywheel gear. When the control switch is closed, the solenoid is energized, shifting the cranking motor pinion into mesh with the ring gear. The main contacts of the solenoid are then closed so that battery current is delivered to the starter motor.

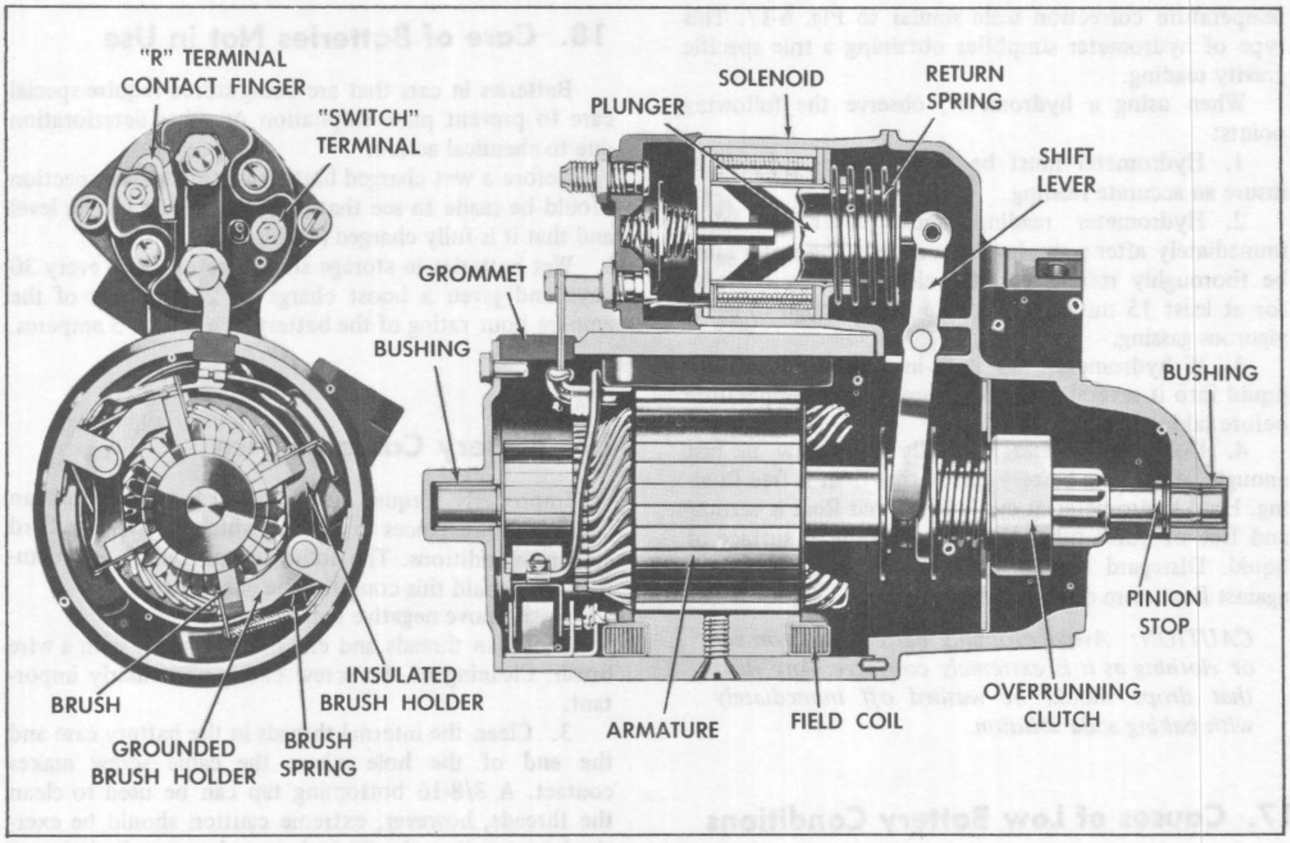


Fig. 6-18 Starter Motor Cutaway View

STARTING SYSTEM DIAGNOSIS

20. Cranking Voltage Test

1. Ground distributor end of coil secondary wire to keep engine from starting. On cars equipped with H.E.I., disconnect harness connector at distributor.
2. With ignition ON and voltmeter on 16 volt scale, crank engine.
3. Observe cranking voltage and engine speed. Voltage should be greater than 9 volts. Cranking speed should be at least 200 RPM (at room temperature).
4. If cranking voltage and engine speed are correct, shut off ignition and disconnect ground on coil secondary wire or re-connect H.E.I. harness connector at distributor.
5. If voltage and engine speed are not correct, further testing of the battery, Notes 11 through 14 and starter circuit, Note 21 must be performed.

21. Starter Motor Circuit Resistance Test

a. Battery Cable and Starter Switch Test—Insulated Circuit Test

This test measures the resistance of the cables and switches that feed the starter motor. The heavy current used by the starter motor will produce a voltage drop in the wiring which can be measured as an indication of this resistance. The battery should be fully charged.

1. Disconnect primary lead of distributor from coil so engine will not start. On cars equipped with H.E.I., disconnect harness connector at distributor.

CAUTION: Do not remove high tension lead from coil center for this purpose, as this may damage the coil due to internal arcing.

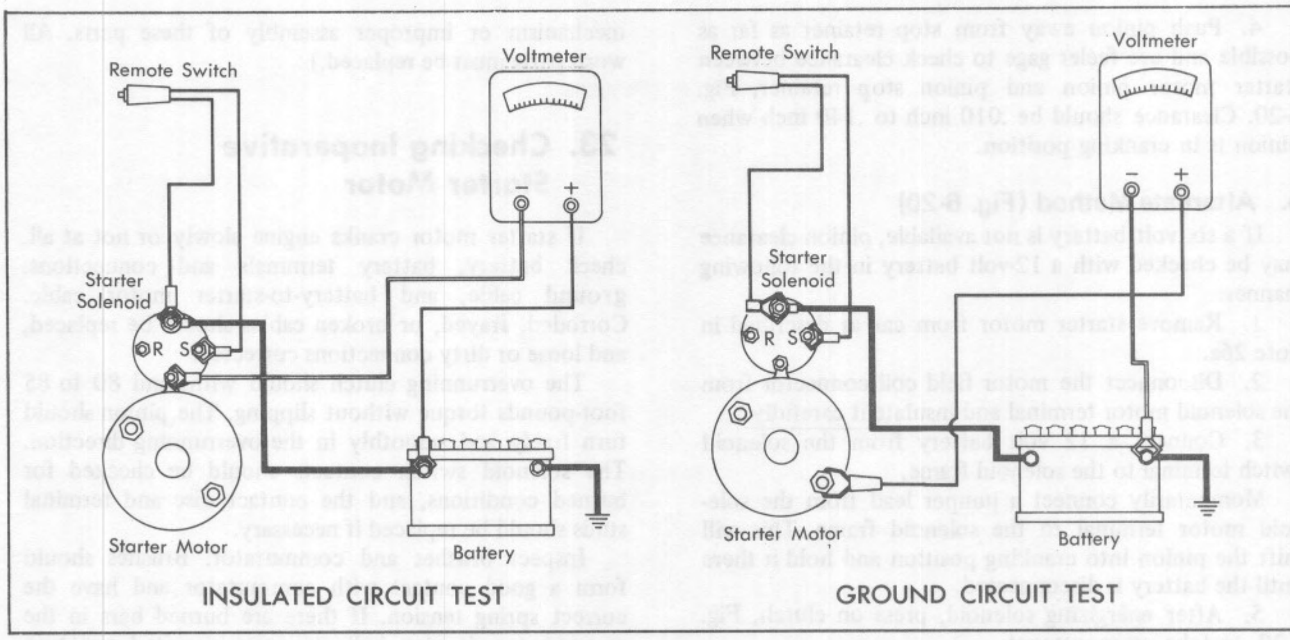


Fig. 6-19 Starting Circuit Tests

2. Using Battery Starter Tester, turn voltmeter selector switch to 16-volt scale.

3. Connect starter solenoid remote switch and test leads as shown in Fig. 6-19.

4. Connect positive voltmeter lead to positive battery terminal screw. Connect negative voltmeter lead to starter "motor" terminal, Fig. 6-19.

5. Close starter solenoid remote switch, and turn voltmeter to 4 volt scale while cranking. Observe reading, and immediately turn meter back to 16 volt scale.

6. Voltmeter should show .6 of a volt or less while engine is being cranked. If voltage drop is more than .6 of a volt, it is an indication that the cables or connections are dirty or corroded, the solenoid switch is defective, the battery is in a low state of charge, the starter motor is drawing too much current, or that the engine is tight.

7. If voltage drop across the entire insulated side of the battery starter circuit exceeds the specified .6 volt, test the individual parts of the insulated circuit for excessive resistance. Maximum voltage drop for each should not exceed the following specifications:

a. Battery to Solenoid Switch	.4 volt
b. Across Solenoid Battery Terminal	.2 volt
c. Solenoid Switch to Starter Terminal	Zero

b. Ground Circuit Test

1. Turn voltmeter selector switch of Battery Starter Tester to 4 volt position.

2. Connect test leads as shown in Fig. 6-19.

3. Connect starter solenoid remote switch as shown in Fig. 6-19.

4. Connect negative voltmeter lead to negative battery terminal screw.

5. Connect positive voltmeter lead to the starting motor through bolt.

6. With starter motor cranking engine, voltage drop should not exceed .3 volt. A reading of more than .3 volt is usually an indication of resistance due to loose, dirty, or corroded connections.

7. Connect primary lead of distributor to coil, or reconnect H.E.I. harness connector at distributor.

22. Checking Starter Motor Pinion Clearance

a. Preferred Method (Fig. 6-20)

1. Remove starter motor from car as described in Note 26a.

2. Energize solenoid by applying 6 volts between solenoid "S" terminal and ground.

CAUTION: Do not use more than 6 volts or motor will operate. As a further precaution, connect a heavy jumper wire from the solenoid motor terminal to ground.

3. After energizing solenoid, press on clutch, Fig. 6-20, to take up movement.

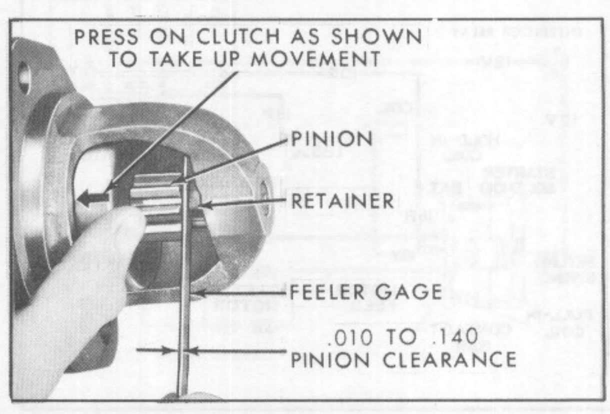


Fig. 6-20 Checking Pinion Clearance

4. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-20. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

b. Alternate Method (Fig. 6-20)

If a six volt battery is not available, pinion clearance may be checked with a 12-volt battery in the following manner:

1. Remove starter motor from car as described in Note 26a.

2. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

3. Connect a 12 volt battery from the solenoid switch terminal to the solenoid frame.

Momentarily connect a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and hold it there until the battery is disconnected.

5. After energizing solenoid, press on clutch, Fig. 6-20, to take up movement.

6. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-20. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

(NOTE: Pinion clearance cannot be adjusted. If clearance is incorrect, disassemble starter motor and check for excessive wear of solenoid linkage, shift lever mechanism or improper assembly of these parts. All worn parts must be replaced.)

23. Checking Inoperative Starter Motor

If starter motor cranks engine slowly or not at all, check battery, battery terminals and connections, ground cable, and battery-to-starter motor cable. Corroded, frayed, or broken cables should be replaced, and loose or dirty connections corrected.

The overrunning clutch should withstand 80 to 85 foot-pounds torque without slipping. The pinion should turn freely and smoothly in the overrunning direction. The solenoid switch contacts should be checked for burned conditions, and the contact disc and terminal studs should be replaced if necessary.

Inspect brushes and commutator. Brushes should form a good contact with commutator and have the correct spring tension. If there are burned bars in the commutator, it may indicate open circuited armature coils that may prevent proper cranking. Inspect soldered connections at commutator rise bars, and resolder any damaged connections.

Tight or dirty bearings will reduce armature speed or prevent the armature from turning. A worn bearing, bent shaft, or loose pole shoe will allow armature to drag, causing slow speed or failure of the armature to rotate. Check for these conditions.

SERVICE INFORMATION

STARTER

24. Starter Motor Circuit

The starter motor is engaged when the ignition key is turned to the extreme right position. Engagement is obtained by means of a solenoid, Fig. 6-21 attached to the starter housing. The solenoid first engages the starter pinion with the flywheel gear and then closes the main switch so that the battery current is delivered to the starter motor.

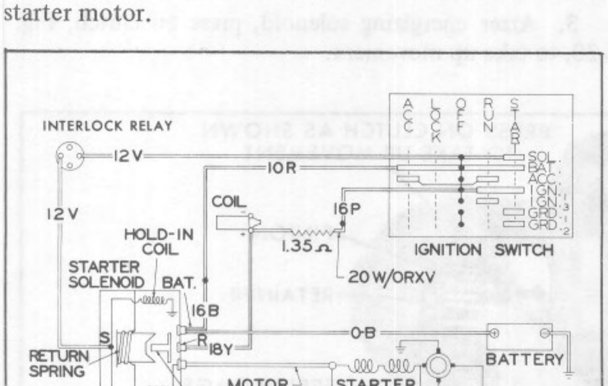


Fig. 6-21 Starting System Circuit

The starter solenoid is drawn into the engaged position by both the pull-in coil and the hold-in coil, and held in position by the hold-in coil only, Fig. 6-21. The contact bar at the end of the solenoid completes a direct circuit between the battery and the starter motor, energizing the starter motor and shorting out the pull-in coil.

The current consumption of the solenoid switch should be 41-47 amperes at 10 volts for both windings, and 14.5 - 16.5 amperes at 10 volts for the hold-in winding alone.

25. Starter Motor Maintenance

When the starter motor is disassembled for service, apply a light coating of lubricant on the bushings in the end bearings. Avoid excessive lubrication, as this might force lubricant out onto the commutator where it would gum and cause high resistance, resulting in poor starter motor performance. Never lubricate the commutator.

26. Starter Motor-Removal and Installation (Fig. 6-22)

a. Removal

1. Disconnect negative battery cable at battery.

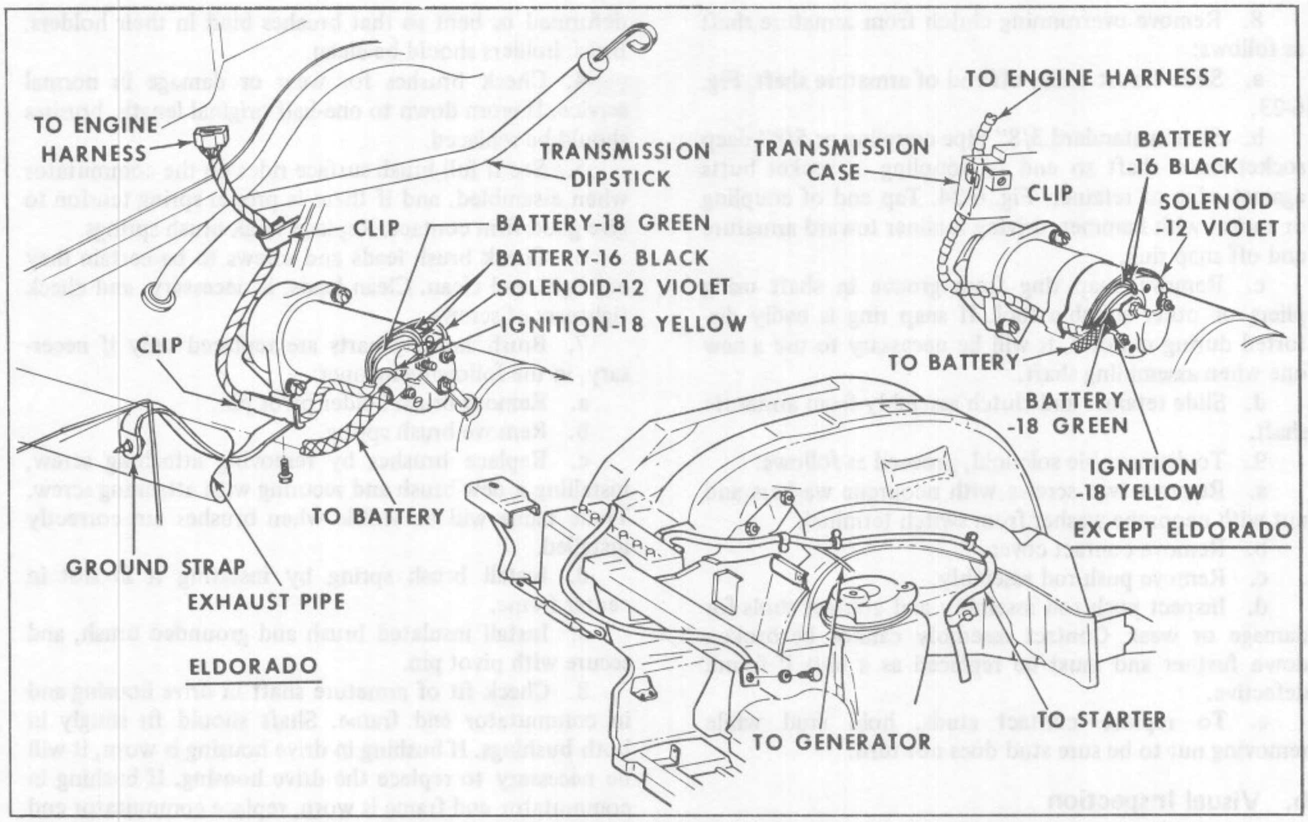


Fig. 6-22 Starter Motor Attaching Parts

2. On Eldorados, disconnect starter harness multiple connector at right rear of engine.

3. Raise front end of car.

4. Disconnect battery lead at starter solenoid terminal (except Eldorado).

5. Disconnect interlock relay wire and coil feed wire at starter solenoid terminals (except Eldorado) and cars equipped with H.E.I.

6. Remove spring clip securing wire to solenoid housing (Eldorado only).

7. Remove screw and nut securing support bracket to starter and crankcase (except Eldorado).

8. Remove two screws that hold starter motor.

9. Remove starter motor by pulling it forward; then toward right front wheel and up over steering linkage toward rear of car.

b. Installation

1. Position starter motor in proper location in flywheel housing.

2. Install two screws holding starter motor. Tighten screws to 46 foot-pounds, Fig. 6-22.

3. Install starter motor support bracket and secure with screw and nut. Tighten screw to 12 ft. lbs. and nut to 6 ft. lbs.

4. On all except Eldorados, install starter motor harness to terminals on solenoid.

5. Install spring clip securing solenoid wires to solenoid housing and connect starter harness to underhood harness at right rear of engine (Eldorado only).

6. Lower car.

7. Connect negative battery cable to battery.

27. Starter Motor—Disassembly, Testing and Assembly

CAUTION: When the starter motor is disassembled for cleaning and inspection of parts, the overrunning clutch, armature, and fields should not be cleaned in a degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricant in the clutch mechanism and would damage the insulation in the armature and field coils. Worn parts should be replaced, and the commutator should be turned down in a lathe if necessary.

a. Disassembly (Fig. 6-18)

1. Disconnect field coil connector from solenoid motor terminal.

2. Remove two screws and lockwashers that hold solenoid switch assembly to starter drive housing and remove solenoid and solenoid return spring by rotating solenoid assembly counterclockwise to release solenoid flange from center frame.

3. Remove two through bolts.

4. Remove commutator end frame and leather brake washer.

5. Remove center frame assembly.

6. Remove snap ring that holds shift lever pivot pin, using snap ring pliers, J-4880, and remove pivot pin from drive housing.

7. Remove plunger and shift lever assembly and armature assembly with overrunning clutch from drive end housing.

8. Remove overrunning clutch from armature shaft as follows:

a. Slide thrust collar off end of armature shaft, Fig. 6-23.

b. Slide a standard 3/8" pipe coupling or 5/8" deep socket onto shaft so end of coupling or socket butts against edge of retainer, Fig. 6-24. Tap end of coupling or socket with hammer, driving retainer toward armature and off snap ring.

c. Remove snap ring from groove in shaft using pliers or other suitable tool. If snap ring is badly distorted during removal, it will be necessary to use a new one when assembling shaft.

d. Slide retainer and clutch assembly from armature shaft.

9. To disassemble solenoid, proceed as follows:

a. Remove two screws with neoprene washers and nut with neoprene washer from switch terminal.

b. Remove contact cover.

c. Remove push rod assembly.

d. Inspect push rod assembly and contact studs for damage or wear. Contact assembly cannot be broken down further and must be replaced as a unit if found defective.

e. To replace contact studs, hold stud while removing nut to be sure stud does not turn.

b. Visual Inspection

CAUTION: The overrunning clutch, armature, and fields should not be cleaned in a degreasing tank, or with grease dissolving solvents, since solvents would dissolve lubricant in clutch mechanism and damage the insulation in armature and field coils.

1. Test overrunning clutch action. Pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked or excessively worn. Replace clutch assembly if necessary.

2. Check bearings for signs of tightness, dirt or wear. Check for a bent armature shaft or a loose pole shoe screw.

3. Check brush holders to see that they are not deformed or bent so that brushes bind in their holders. Brush holders should be clean.

4. Check brushes for wear or damage in normal service. If worn down to one-half original length, brushes should be replaced.

5. See if full brush surface rides on the commutator when assembled, and if there is proper spring tension to give good firm contact. Replace weak brush springs.

6. Check brush leads and screws to be certain they are tight and clean. Clean leads, if necessary, and check tightness of screws.

7. Brush holding parts are replaced only if necessary, in the following manner:

a. Remove brush holder pivot pin.

b. Remove brush spring.

c. Replace brushes by removing attaching screw, installing a new brush and securing with attaching screw. Trade name will be visible when brushes are correctly installed.

d. Install brush spring by inserting it in slot in center frame.

e. Install insulated brush and grounded brush, and secure with pivot pin.

8. Check fit of armature shaft in drive housing and in commutator end frame. Shaft should fit snugly in both bushings. If bushing in drive housing is worn, it will be necessary to replace the drive housing. If bushing in commutator end frame is worn, replace commutator end frame.

9. Inspect leather brake washer for damage, and replace, if necessary.

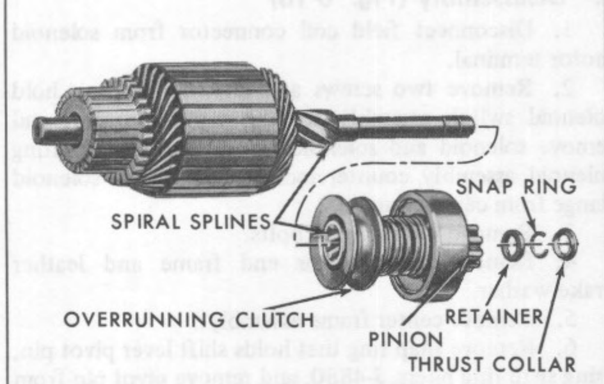


Fig. 6-23 Starter Armature Assembly

c. Checking Armature for Shorts

1. Place armature in growler. Lock armature in position by securing clamp on the commutator. Turn ON-OFF switch on.

2. Rotate armature while holding steel strip that comes with the tester near the armature. Steel strip will vibrate in the area of a short circuit. Turn off switch.

d. Checking Armature for Opens

1. Inspect the points where conductors are joined to the commutator for loose connections. Poor connections can cause arcing and burning of the commutator.

2. If bars are not badly burned, resolder leads in riser bars. Have commutator turned down in a lathe.

e. Checking Armature for Grounds

Check for grounds with aid of a 110-volt test lamp.

1. Remove armature from armature tester and place on bench.

2. Place one test lamp lead on the commutator.

3. Touch other test lamp lead to armature core and then armature shaft. If lamp lights, the armature is grounded.

If the commutator is worn, dirty or out of round, a ground condition may result. If a ground is indicated, have commutator turned down in a lathe.

f. Checking Field Coils for Grounds

Check field coils for grounds and opens, using 110-volt test lamp.

a. Connect one lead of test lamp to motor feed terminal and other to any clean surface of field frame. Lamp should not light.

If lamp lights, field coils are grounded and must be replaced.

g. Checking Field Coils and Insulated Brush Holder Leads

1. With center frame assembly positioned so that brush holders are on top, push upper motor feed terminal from center frame assembly.

2. Touch one test lamp lead to each of motor feed terminals. Lamp should light. If it does not light, there is an open in field coils and field coil assembly must be replaced.

3. If the lamp lights, perform Step 4 to check insulated brush holder leads.

4. Hold one test lamp lead to either motor feed terminal. Touch other lead in turn to two pigtail leads of insulated brushes. Lamp should light.

If lamp does not light in either instance, leads should be repaired by soldering. Be sure to install upper motor lead in grommet.

h. Assembly

1. To assemble solenoid, proceed as follows:

a. Install contact studs, holding studs while tightening nut to be sure stud does not turn.

b. Install push rod assembly.

c. Install contact cover with switch terminal stud through square hole. Secure with two screws with plastic

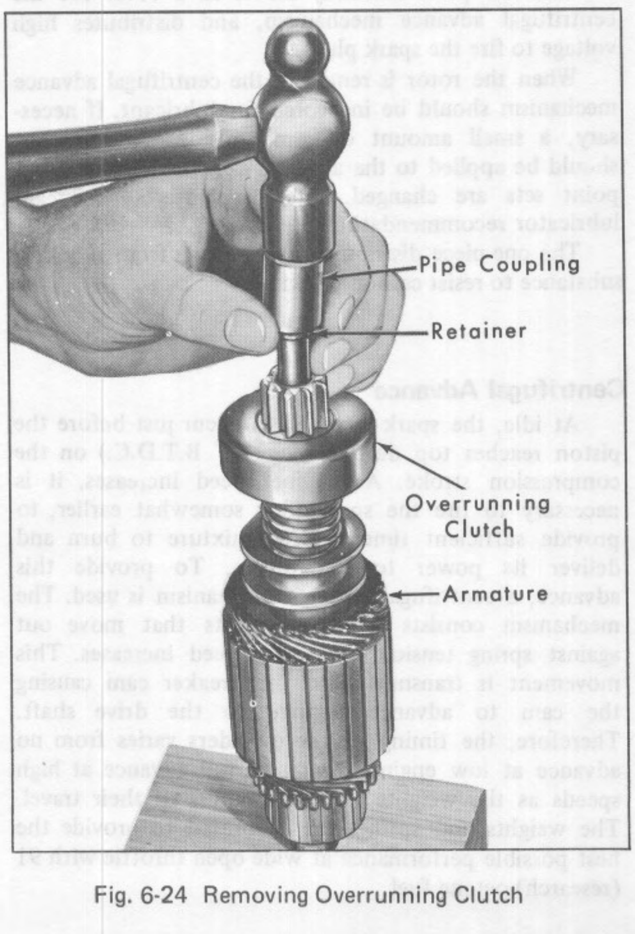


Fig. 6-24 Removing Overrunning Clutch

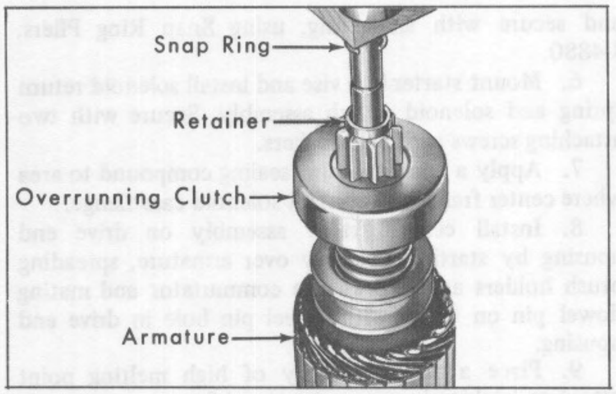


Fig. 6-25 Installing Snap Ring on Shaft

washers and lock nut with plastic washer on switch terminal stud.

2. Assemble overrunning clutch to armature shaft as follows:

a. Lubricate drive end of armature shaft with a few drops of SAE 30W oil.

b. Slide clutch assembly onto armature shaft with pinion outward, Fig. 6-24.

c. Slide retainer onto shaft with cupped surface facing end of shaft, Fig. 6-24.

d. Stand armature on end of a wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with either a piece of wood or a 7/16" socket. Tap socket or block with hammer to force snap ring on end of shaft, Fig. 6-25. Slide snap ring down to the second groove.

e. Assemble thrust collar on shaft with shoulder next to snap ring, Fig. 6-26.

f. Position retainer and thrust collar next to snap ring. Using two pairs of pliers, grip retainer and thrust collar and squeeze until snap ring is forced onto retainer, Fig. 6-26.

3. Place a small quantity of high melting point grease in drive end housing grease retainer.

4. Position legs of shift lever assembly in grooves of overrunning clutch. Install armature and overrunning clutch assembly into drive end housing, making certain that thrust washer is in place on end of shaft.

5. Install shift lever pivot pin into recess in housing

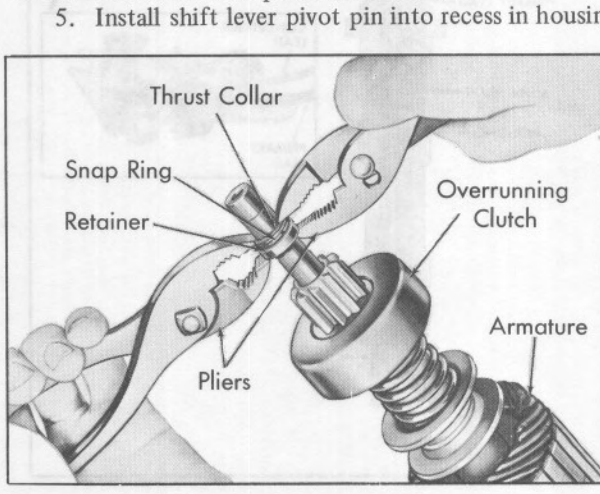


Fig. 6-26 Installing Snap Ring on Retainer

and secure with snap ring, using Snap Ring Pliers, J-4880.

6. Mount starter in a vise and install solenoid return spring and solenoid switch assembly. Secure with two attaching screws and lock washers.

7. Apply a non-hardening sealing compound to area where center frame will contact solenoid case flange.

8. Install center frame assembly on drive end housing by starting assembly over armature, spreading brush holders apart to engage commutator and mating dowel pin on frame with dowel pin hole in drive end housing.

9. Place a small quantity of high melting point grease on bushing in commutator end frame.

10. Place leather brake washer on armature shaft.

11. Slide commutator end frame on shaft and secure with two through bolts.

12. Install field coil terminal connector on solenoid motor terminal, securing with self-tapping screw and star washer.

28. Fusible Links

Fusible links are used to protect the engine primary harness at the starter motor. Fusible link wire is usually 4-6 wire gage sizes smaller than the circuit it protects. Should the fusible link wire break as the result of a short circuit, first find the source of the short circuit and repair. Because of the smaller diameter wire, a small change in the length of the fusible link would result in a large change in the "fuse rating" of the wire. For this reason it is important to replace damaged fusible links with a new piece of fusible link wire, cut to the correct length, which is available from various sources.

THEORY OF OPERATION

BREAKER-TYPE IGNITION SYSTEM

Distributor

An aluminum alloy ignition distributor Fig. 6-27, is mounted on the top left front of the engine. It is fully automatic in operation, and driven by an alloy iron gear that meshes with a gear that is integral with the camshaft. The distributor cam rotates in a clockwise direction when viewed from above. The firing order is 1-5-6-3-4-2-7-8.

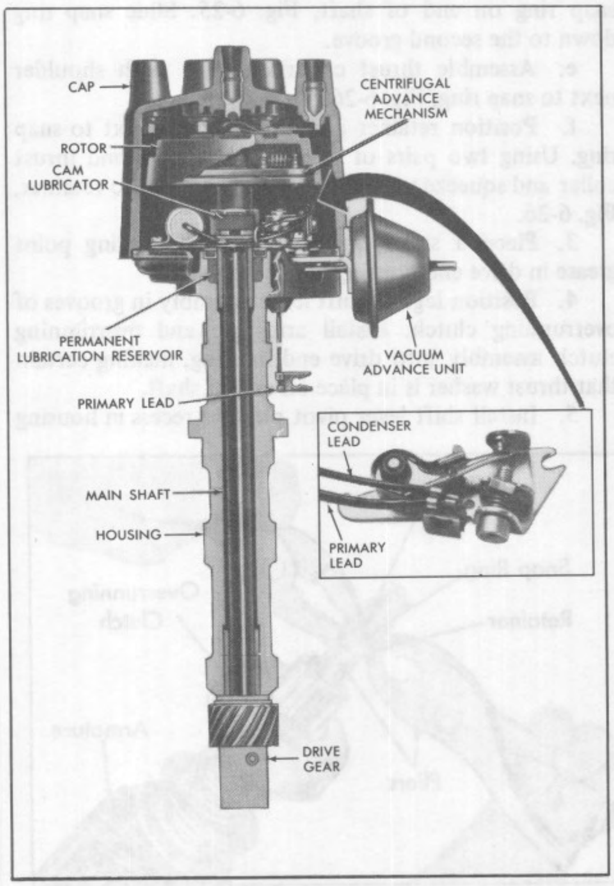


Fig. 6-27 Distributor Cutaway View

The distributor houses the contact points that make and break the primary circuit, and also directs high voltage and current in proper sequence to the spark plugs. The distributor contact point set is replaced as a complete assembly. The breaker lever spring tension and point alignment on the replacement set are factory adjusted, leaving only the dwell angle to be adjusted after installation.

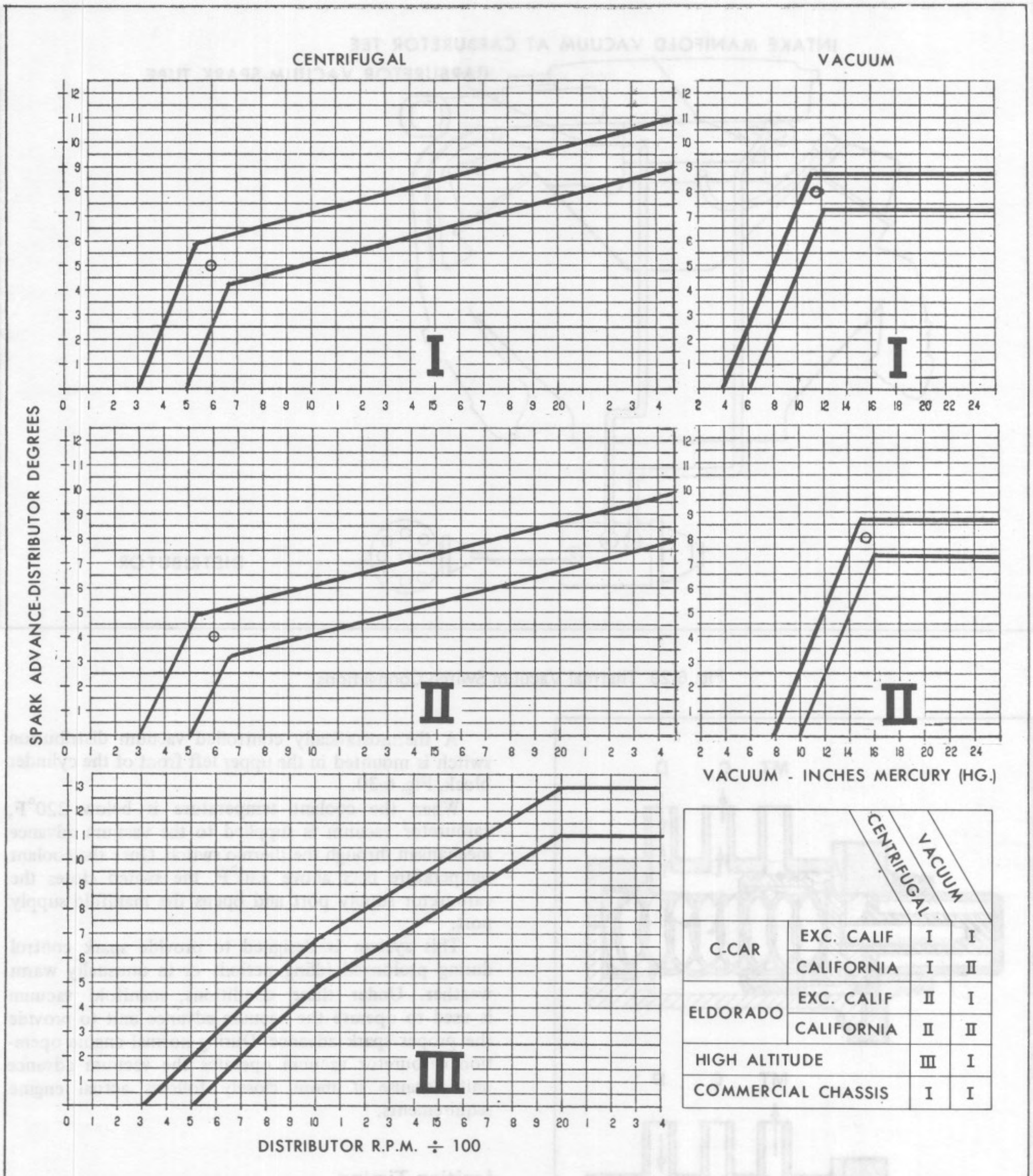
The large molded distributor rotor, located above the breaker plate assembly serves as a cover for the centrifugal advance mechanism, and distributes high voltage to fire the spark plugs.

When the rotor is removed, the centrifugal advance mechanism should be inspected for lubricant. If necessary, a small amount of cam and bearing lubricant should be applied to the advance weights. When contact point sets are changed, refer to Note 36 for cam lubricator recommendations.

The one-piece distributor cap is made from an alkyd substance to resist carbon tracking.

Centrifugal Advance

At idle, the spark is timed to occur just before the piston reaches top dead center (10° B.T.D.C.) on the compression stroke. As engine speed increases, it is necessary to fire the spark plug somewhat earlier, to provide sufficient time for the mixture to burn and deliver its power to the piston. To provide this advance, a centrifugal advance mechanism is used. The mechanism consists of two weights that move out against spring tension as engine speed increases. This movement is transmitted to the breaker cam causing the cam to advance relative to the drive shaft. Therefore, the timing of the cylinders varies from no advance at low engine speeds to full advance at high speeds as the weights reach the limits of their travel. The weights and springs are calibrated to provide the best possible performance at wide open throttle with 91 (research) octane fuel.



		CENTRIFUGAL	VACUUM
C-CAR	EXC. CALIF	I	I
	CALIFORNIA	I	II
ELDORADO	EXC. CALIF	II	I
	CALIFORNIA	II	II
HIGH ALTITUDE		III	I
COMMERCIAL CHASSIS		I	I

Fig. 6-28 Distributor Centrifugal and Vacuum Advance Specifications

Vacuum Advance

During part throttle conditions a partial vacuum is developed in the intake manifold. Since less air and fuel are admitted, the mixture is less highly compressed. Under these conditions, the mixture will burn slower and, in order to achieve full power, the spark must be advanced. The vacuum sensitive advance mechanism, Fig. 6-27, consists of a spring loaded diaphragm connected by linkage to the breaker plate. The spring loaded side of the diaphragm is connected to the carburetor through the Thermal Vacuum Switch, Fig. 6-29. With the throttle closed, no vacuum is available and there is no vacuum advance. As the throttle is opened it passes the vacuum port allowing the line and vacuum advance unit to be evacuated. With the diaphragm chamber evacuated, the diaphragm moves against spring pressure to rotate the breaker plate allowing the cam to open and close the points earlier in the cycle.

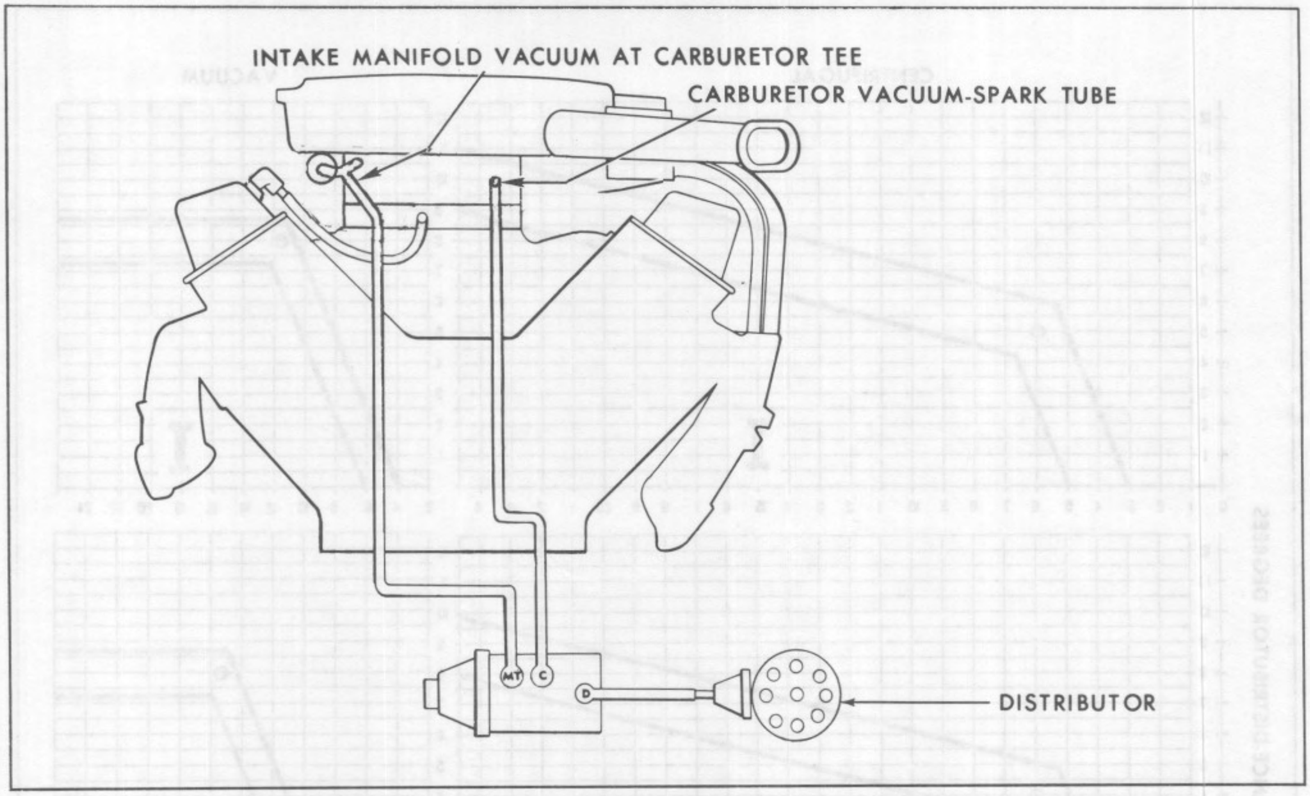


Fig. 6-29 Thermal Vacuum Switch Connections

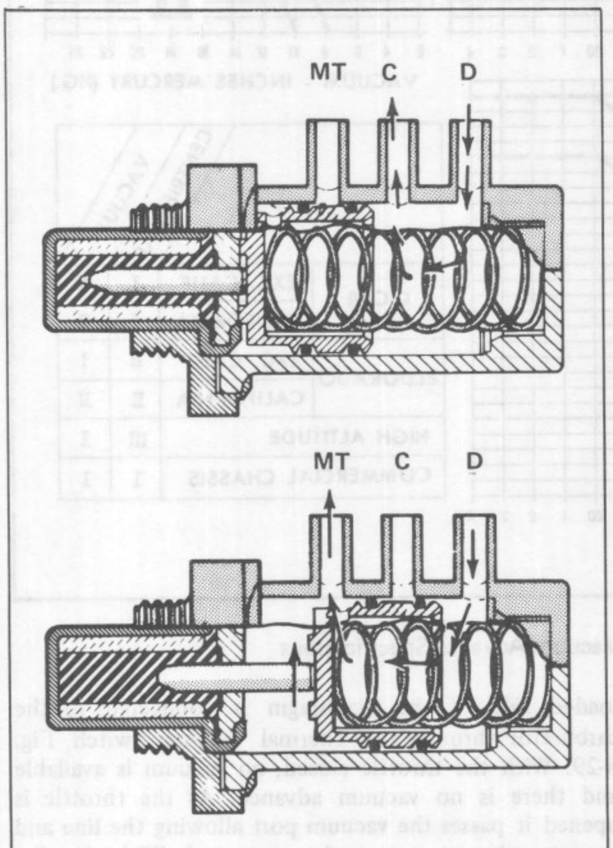


Fig. 6-30 Thermal Vacuum Switch Operation

A thermostatically controlled vacuum distribution switch is mounted in the upper left front of the cylinder block, Fig. 6-30.

When the coolant temperature is below 220°F, carburetor vacuum is supplied to the vacuum advance mechanism through the thermo switch. Once the coolant temperature rises above 230°F, the switch closes the carburetor supply port and opens the manifold supply port.

This system is designed to provide spark control during prolonged idling periods or in unusually warm weather. Under these conditions, manifold vacuum is used to operate the vacuum advance unit to provide the proper spark advance. During normal engine operation carburetor vacuum operates the vacuum advance unit because it more closely follows actual engine requirements.

Ignition Timing

On the left side of the engine front cover directly below the distributor is a tab with notches to indicate degrees of crankshaft advance (see Fig. 6-34). The pistons in number one and number four cylinders are at top dead center when the "O" notch is in line with notch on the rear flange of the pulley. The marks indicate the number of crankshaft degrees the spark plug will fire before or after the top dead center position of the piston.

Secondary Circuit

Type R45NS spark plugs are installed as original

equipment on all Cadillac engines. A ribbed insulator is used to reduce the possibility of voltage breakdown.

Radio suppression spark plugs are used in addition to resistance core spark plug cables to reduce ignition noise radiated into the atmosphere.

The oil-impregnated ignition coil is mounted on top of the intake manifold in front of the carburetor. The interrupted low tension voltage from the battery produces a high voltage in the secondary circuit of the coil. A resistance type wire is connected from the ignition switch to the ignition coil in the primary circuit. This resistor reduces the voltage at the coil from 12 volts down to range of 8-1/2 to 10-1/2 volts under normal operating conditions. To insure adequate ignition voltage during the engine cranking period, the resistor wire is by-passed by a feed from the starter solenoid, and full cranking voltage is supplied to the ignition coil during this period.

BREAKER-TYPE IGNITION SYSTEM DIAGNOSIS

29. Distributor Test Information (Breaker-Type and High Energy Ignition)

a. Distributor Tests

For service departments equipped with distributor testing machines, information on distributors is furnished as follows:

Five breaker-type and five High Energy Ignition distributors are used. The respective centrifugal and vacuum advance curves are illustrated in Fig. 6-28.

If tests indicate an improperly operating mechanism, disassemble the distributor as described in Note 32a or 43a. Reassemble the distributor as described in Note 32b or 43b.

b. Thermal Vacuum Switch Test

To check the operation of the switch, proceed as follows:

1. Operate engine at 600 rpm and at normal operating temperature.
2. Disconnect hose from distributor vacuum advance unit and check to see that vacuum is available (to port "D").
3. With distributor hose disconnected, remove hose between switch and vacuum break "tee" at carburetor.
4. Vacuum should still be available at distributor hose (port "D" and should not be available at hose disconnected in step #3 (port "MT").
5. To raise engine temperature to check transition of vacuum sources, block radiator with cardboard until "STOP ENGINE" light comes on.
6. Reconnect hose removed in step #3 (switch to vacuum break "tee") and remove hose between carburetor and port "C" of the switch.
7. Vacuum should be available at distributor hose (port "D") and should not be available at hose disconnected in step 6.
8. Make normal connections.
9. Should any of the above checks indicate an improperly operating switch, the switch should be replaced.

30. Ignition Primary Circuit Resistance Test

Excessive voltage drop in the primary circuit will lessen the secondary output of the ignition coil, resulting in hard starting and poor performance.

1. Turn the voltmeter selector switch of the Volt-Ampere Tester to the 4 volt position.
2. Connect test leads as shown in Fig. 6-31.
3. Remove coil secondary wire from distributor and ground.
4. Close breaker points by rotating engine a fraction of a revolution at a time with starting motor.
5. Be sure all lights and accessories are turned off.
6. Turn ignition switch "On". Voltmeter should read not more than .4 volt.
7. Test ignition switch by turning it off and on several times. Voltmeter should record the same reading each time switch is turned on.

(NOTE: While switch is being turned on and off, key should be jiggled in switch several times and voltmeter checked for any change in readings.)

8. Test all wires for tightness. Move them about and note any change in meter reading.
9. Remove voltmeter leads and place them across the primary wires from coil to distributor as shown by dotted leads in Fig. 6-31. Voltmeter should read less than .1 volt.

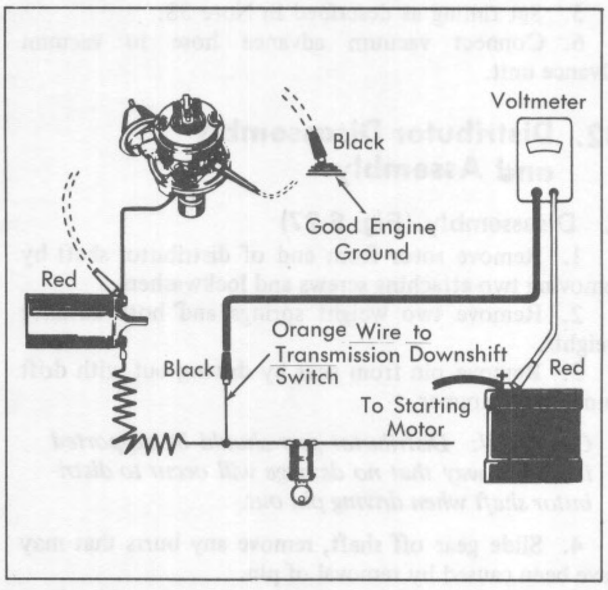


Fig. 6-31 Ignition Primary Circuit

(NOTE: If voltmeter reading exceeds .1 volts, isolate the point of this resistance by placing the test leads across each connection and wire in order. The reading across a connection should be proportional to its length as compared to the length and allowable voltage drop of the entire circuit.)

SERVICE INFORMATION
BREAKER-TYPE IGNITION SYSTEM

31. Distributor Removal and Installation

a. Removal

1. Remove distributor cap and position out of way.
2. Disconnect distributor primary wire from coil.
3. Disconnect vacuum advance hose from vacuum advance unit on distributor.
4. Crank engine until contact on top of rotor points directly to No. 1 spark plug firing position. Mark the position on distributor housing.
5. Remove distributor hold down nut and clamp.
6. Lift distributor from engine.

b. Installation

1. Install distributor with contact on top of rotor pointing slightly counterclockwise from No. 1 spark plug firing mark. As distributor gear meshes with cam gear, rotor will turn slightly clockwise. When distributor is properly installed, rotor should point directly at No. 1 spark plug firing position mark.

(NOTE: If engine has been cranked, remove No. 1 spark plug. Place thumb over port. Crank engine until compression is noticed and continue until No. 1 piston is at top dead center. In this position, the timing mark "O" on the engine front cover lines up with the scribe mark on the harmonic balancer.)

2. Install distributor hold-down clamp and nut.
3. Connect distributor primary lead.
4. Install distributor cap.
5. Set timing as described in Note 38.
6. Connect vacuum advance hose to vacuum advance unit.

32. Distributor Disassembly and Assembly

a. Disassembly (Fig. 6-27)

1. Remove rotor from end of distributor shaft by removing two attaching screws and lockwashers.
2. Remove two weight springs and both advance weights.
3. Remove pin from gear by driving out with drift punch and hammer.

CAUTION: Distributor gear should be supported in such a way that no damage will occur to distributor shaft when driving pin out.

4. Slide gear off shaft, remove any burrs that may have been caused by removal of pin.
5. Pull shaft with cam weight base assembly from housing.
6. Remove contact point assembly and disconnect primary and capacitor lead clips.
7. Remove capacitor hold-down screw and remove capacitor and bracket from breaker plate.
8. Remove spring retainer and raise breaker plate from housing.
9. To remove vacuum advance unit, remove two attaching screws, lockwashers, and plate with ground lead.
10. Remove primary lead by prying rubber grommet out of base housing.
11. Remove felt washer from bushing in housing.

(NOTE: No attempt should be made to service shaft bushing in housing.)

b. Assembly

1. Place felt washer over bushing in housing.
2. Slide primary lead through opening in base of housing and seat grommet in housing.
3. Place vacuum advance unit in space provided in housing and retain in position by installing one screw in hole in mounting arm furthest from advance unit.
4. Secure distributor ground lead to vacuum advance unit with second mounting screw. Primary wire should cross over ground lead.
5. Install breaker plate assembly over bushing so that assembly is positioned over vacuum advance operating arm.
6. Install spring retainer.
7. Place capacitor and bracket in position on breaker plate and secure with one screw.
8. Install contact point assembly.
9. Install capacitor and primary leads as shown in Fig. 6-27.
10. Install shaft with cam weight base assembly into housing.
11. Install gear on shaft and secure with pin. Use new pin.
12. Install both advance weights on cam weight base and secure with two springs.
13. Install rotor and secure with two screws and lockwashers.

CAUTION: The square and round lugs on bottom of rotor must be positioned with corresponding holes on cam weight base.

33. Distributor Vacuum Advance Controls (Fig. 6-29)

The thermal vacuum switch, Fig. 6-29, is designed primarily to help prevent overheating by providing full vacuum spark advance during prolonged idling periods or

during unusually warm weather. Under these conditions spark advance is desirable, and since carburetor spark vacuum is low, stronger manifold vacuum is used to override the spark control system and operate the vacuum advance unit. During normal operation, carburetor vacuum (spark port vacuum) operates the vacuum advance unit because it more closely follows actual engine requirements.

When coolant temperature is below 220°F carburetor vacuum is supplied to the distributor vacuum advance mechanism through thermal vacuum switch connections "C" and "D", Fig. 6-30. As coolant temperature approaches 220°F, wax in the bulb expands, forcing the plunger out against the spring. When 220°F is reached, the wax has expanded enough to force the plunger against spring pressure to close off port "C" and open port "MT". Manifold vacuum, available at port "MT", is now used to operate the vacuum advance mechanism, Fig. 6-30.

When coolant temperature drops below 220°F, spring pressure forces the plunger back to its normal position. This is made possible because the cooling of the wax has caused it to contract back to its normal shape. Once this operation is completed, carburetor vacuum is again used to control the spark advance unit.

When a car with this switch has overheating problems during city traffic or prolonged idle, part of the trouble could be due to an inoperative switch. If all other checks of the cooling system show the system is in order, check the vacuum switch as described in Note 29b.

34. Engine Tune-Up

Refer to the 1974 Cadillac Maintenance Schedule, Section 0, Vehicle Emission Maintenance Section for complete engine tune-up procedures and time and/or mileage intervals.

35. Tune-Up Instrumentation

Figure 6-32 illustrates the basic instrumentation required to perform the following tune-up procedures. If further testing is required such as coil tests, condenser tests, or cylinder leakage tests, the equipment manufacturer's recommendations, supplied with the test equipment to be used, should be followed for procedures. The specifications for such tests appear on page 6-51 of this manual.

The basic connections shown in Fig. 6-32 are as follows:

1. Voltmeter
   a. Positive lead to positive battery post.
   b. Negative lead to ground.
2. Timing Light
   a. Positive lead to positive battery post.
   b. Negative lead to ground.
   c. Trigger lead to No. 1 spark plug, either at plug or distributor cap. No. 1 spark plug is the front cylinder on the right (passenger) side of engine.
3. Tachometer and Dwell Meter
   a. Positive lead to distributor side of coil.
   b. Negative lead to ground.

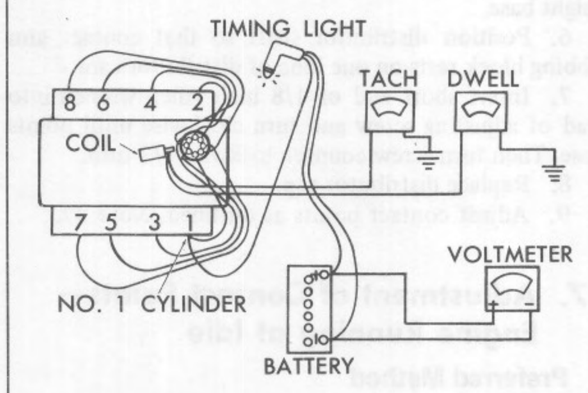


Fig. 6-32 Tune—Up Instrumentation

36. Distributor Contact Points

a. Inspection

Remove distributor cap by inserting a screwdriver in upper slotted end of cap retainers, press down and turn until latches are disengaged.

Pitted or oxidized points should be replaced. Contact points with an oily surface should be inspected for pitted or oxidized condition. The source of oil should be located and corrected. If the points are worn evenly and show a uniform gray surface, they do not need attention, provided the dwell angle is within limits (28° to 32°).

b. Removal

1. Remove distributor cap.
2. Remove two screws that secure rotor cap to distributor and remove cap.
3. Remove capacitor lead and primary lead from nylon insulated connection.
4. Loosen two screws that hold base of contact set assembly in place, and remove contact points.
5. Inspect condition of advance weights. If necessary, add a small amount of cam and bearing lubricant to the advance weights.

c. Installation

1. Rotate distributor cam lubricator 1/2 turn at first, third, etc. tune-ups. Replace lubricator at second, fourth, etc. tune-ups.
2. Lubricate the distributor cam lubricator (if not replaced) with a small amount of distributor cam lubricant part number 1948792 or equivalent.
3. Position replacement points and tighten screws.
4. Install capacitor lead, primary lead and secure with spring clip retainer, Fig. 6-27.

(NOTE: Leads must be properly positioned, as shown in Fig. 6-27, to eliminate interference between cap, weight base, and breaker advance plate.)

5. Install rotor cap and secure with two attaching screws, Square and round lugs on the bottom of the rotor must be aligned with corresponding holes on cam weight base.

6. Position distributor shaft so that contact arm rubbing block rests on one lobe of distributor cam.

7. Insert short end of 1/8 inch Allen wrench into head of adjusting screw and turn clockwise until points close. Then turn screw counterclockwise 1/2 turn.

8. Replace distributor cap.

9. Adjust contact points as outlined, Note 37.

37. Adjustment of Contact Points—Engine Running at Idle

a. Preferred Method

1. Connect a dwell meter to distributor primary lead, Fig. 6-32.

2. Lift adjustment window and insert short end of 1/8" Allen wrench into lead of adjusting screw, Fig. 6-33.

3. Turn adjusting screw until 30° dwell angle is obtained as measured by dwell meter.

4. Last adjustment should be made by turning clockwise, in order to maintain a more uniform gap.

(NOTE: It is unnecessary to check point gap, because of close manufacturing tolerances. The gap will be correct if the dwell angle is 30°.)

b. Alternate Method

1. Lift adjustment window and insert short end of 1/8" Allen wrench into head of adjusting screw, Fig. 6-33.

2. Turn adjusting screw in (clockwise) until engine begins to misfire.

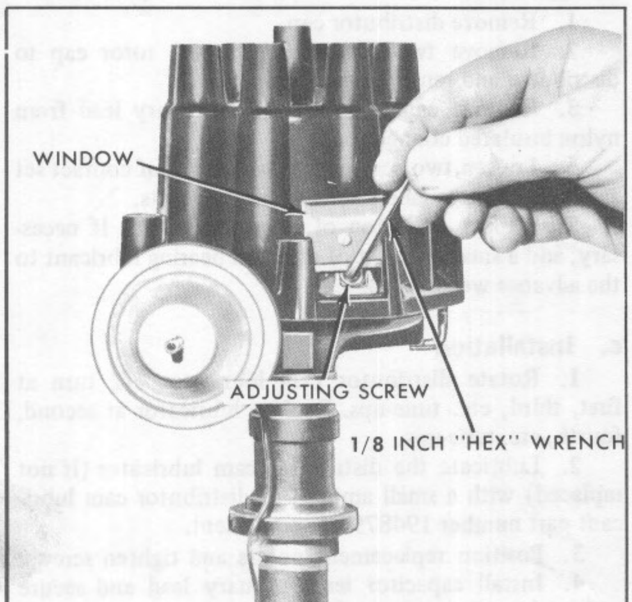


Fig. 6-33 Adjusting Distributor Point Dwell

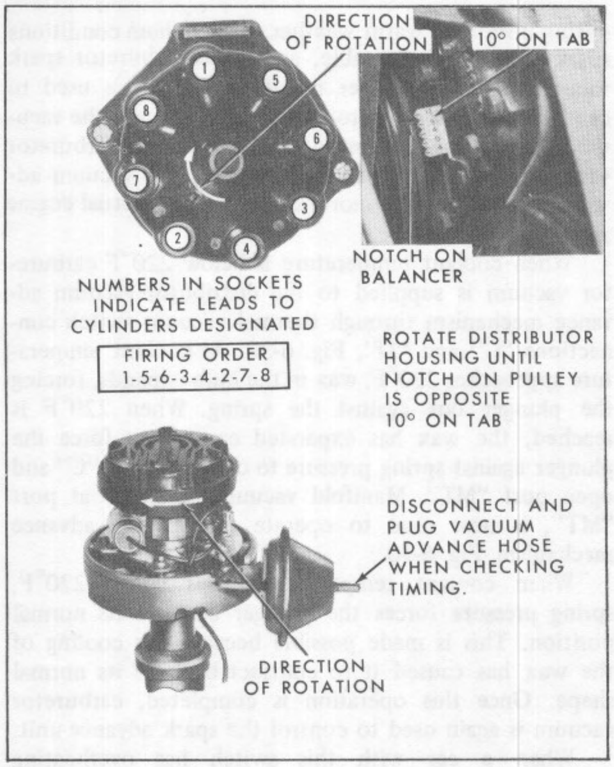


Fig. 6-34 Ignition Timing Adjustment

3. Turn wrench 3/4 turn (270°) in opposite direction (counterclockwise), and then turn clockwise 1/4 turn (90°) to obtain proper gap and dwell.

38. Ignition Timing Adjustment

1. Adjust distributor clamp nut to allow distributor to be turned by hand, but without excessive looseness.

2. Disconnect vacuum advance unit hose at distributor and place a piece of tape over end of hose. This is important, as a manifold leak will affect timing adjustments.

3. Disconnect parking brake vacuum hose at diaphragm and place a piece of tape over end of hose to prevent any air leak.

4. Insert an adapter pin alongside No. 1 or No. 4 ignition wire in distributor cap, if spark plug connectors are not available.

5. Connect a suitable timing light to adapter or connector.

(NOTE: Make sure that timing marks and scribe marks are clean.)

6. Disconnect and plug A.L.C. hose on cars so equipped.

7. Connect tachometer, Fig. 6-32, to engine and set parking brake securely. Place transmission selector lever in neutral or park position.

8. Start engine and warm to operating temperature.

9. Set idle speed at 600 rpm with transmission selector lever in "DRIVE" position.

10. Observe timing light flashes on pulley in

relation to notches on front cover. Set timing to 10 degrees before top dead center, Fig. 6-34.

11. Recheck idle speed and reset to 600 RPM if required. RPM can vary with changes in timing.

12. Tighten clamp nut to 18 foot-pounds, and recheck timing to make sure that it did not change.

13. Remove tape from vacuum advance hose and connect hose to vacuum advance unit.

14. Remove tape from parking brake vacuum hose.

15. Disconnect tachometer and timing light, and remove adapter pin or connector from engine.

39. Spark Plug Cleaning and Adjustment

Type R45NS spark plugs are used on all engines.

The conditions of the compound in the spark plug cleaner is important. It must be dry, because if moist, it could pack in the space between the insulator tip and shell, allowing only the tip of the plug to be cleaned. Also, the compound must be sharp to do a good cleaning job. After prolonged use, the particles of compound lose their sharp cutting edges and will not clean properly.

With the spark plug in the cleaner and the air blast turned on, press the cleaner hood down, rocking the plug. Raise the cleaner hood to the air blast position for a few seconds. Rotate the plug in its adapter and repeat the operation until the entire insulator is clean (white). It should be noted here that some spark plugs may have fused deposits on the lower insulator tips that are difficult, if not impossible, to remove. Make sure that all cleaning compound is removed from the plug.

File elctrodes flat and set gap to .035 inch. The gap should be checked only with a round wire gage. Use new gaskets when installing plugs, and tighten to 25 foot-pounds.

40. Fluid Level Checks

1. Check master cylinder reservoir for proper level, fluid should be 1/4 inch below top of reservoir.

2. Check power steering pump fluid level, should be at full mark on dipstick.

3. Check battery cell level, should be at bottom of filler wells.

4. Check level of coolant in reservoir. Should be between ADD and FULL marks. Check coolant for freeze protection, should be at least -40°F.

5. Check engine oil and adjust to proper level or change as required.

6. Check transmission fluid level as indicated in Section 7.

41. Additional Tests

Additional tests as required should be performed following either the procedure found in the appropriate section of this manual or if no procedure is found, follow equipment manufacturer's recommendations. Specifications for such tests are found at the back of the appropriate section of this manual.

THEORY OF OPERATION HIGH ENERGY IGNITION SYSTEM

The High Energy Ignition System, Fig. 6-35 features a built-in ignition coil, an electronic module and a magnetic pick-up assembly. The module and pick-up assembly take the place of the conventional contact points and condenser.

The HEI system is designed to provide high output secondary voltages. The system is energized by one wire from the ignition switch. The eight spark plug wires complete the entire external wiring circuit.

A terminal is provided in the cap to which a tachometer can be connected. A connector plugs into the cap to connect the pick-up assembly and electronic module to the ignition coil.

Ignition Coil

In the HEI system, Fig. 6-36, the ignition coil is built into the distributor cap. The coil is somewhat smaller physically than a conventional coil, but has more primary and secondary windings. It is built more like a true transformer with the windings surrounded by the laminated iron core. A conventional coil has the iron core inside the windings. Although the HEI coil operates in basically the same way as a conventional coil, it is more effective in generating higher secondary voltage when the primary circuit is broken.

Electronic Module

The electronic module is a solid state unit containing five complete circuits which control spark triggering, switching, current limiting, dwell control and distributor pick-up. Dwell angle is controlled by a transistor circuit within the module and is varied in direct relation to engine speed.

Pick-Up Assembly

The pick-up assembly consists of the following:

1. A rotating timer core with eight external teeth which is turned by the distributor shaft.

2. A stationary pole piece with eight internal teeth.

3. A pick-up coil and magnet which are located between the pole piece and a bottom plate.

Centrifugal and Vacuum Advance

The centrifugal and vacuum advance mechanisms are basically the same types of units that provide spark advance in the breaker-type system. Centrifugal advance

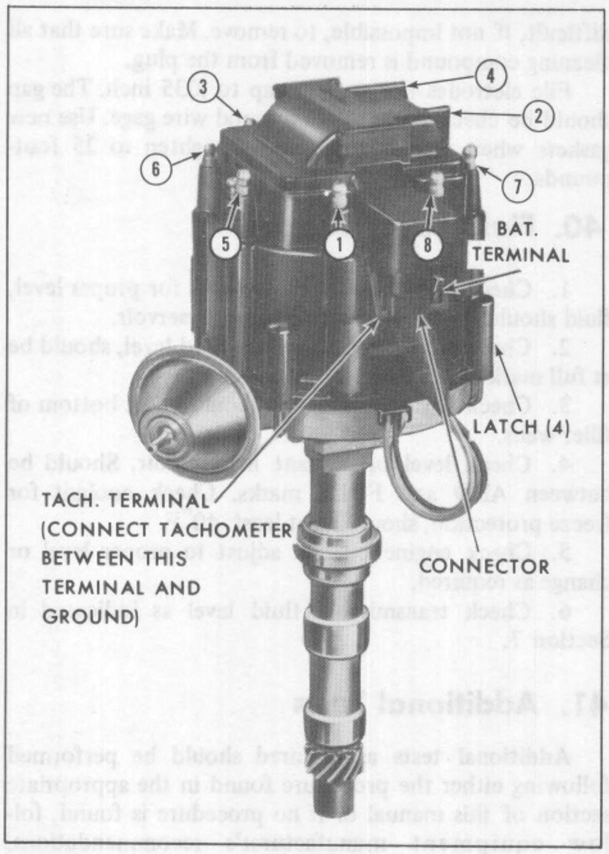


Fig. 6-35 High Energy Ignition System

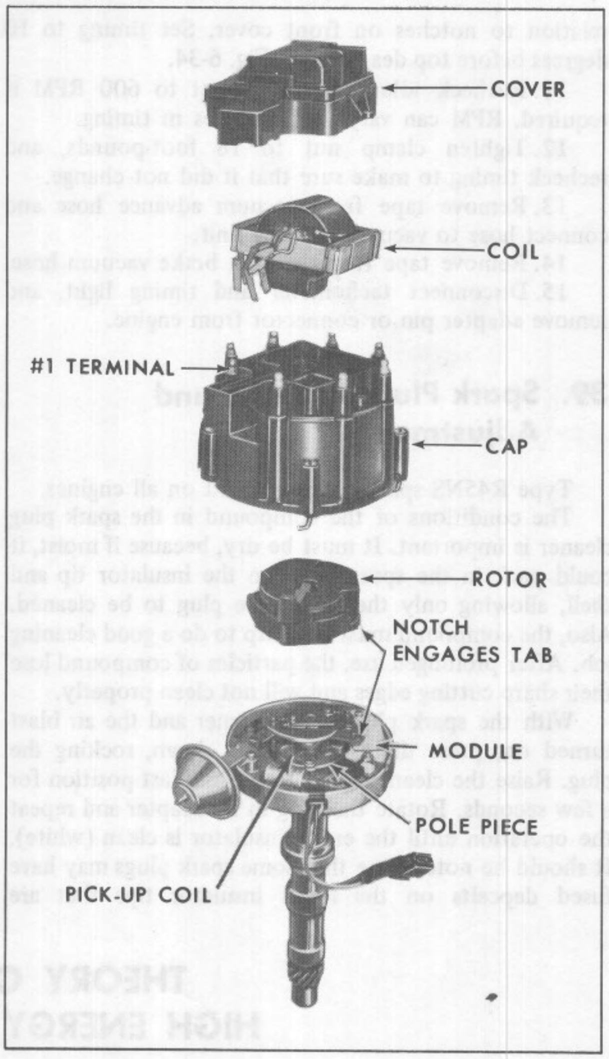


Fig. 6-36 High Energy Ignition — Disassembled

is achieved through the rotation of the timer core in relation to the distributor shaft. Vacuum advance is achieved by attaching the pick-up coil and pole piece to the vacuum advance unit actuating arm.

Operation

The pick-up coil is connected to transistors in the electronic module. The electronic module is connected to the primary windings in the coil. As the distributor shaft turns the timer core teeth out of alignment with the teeth of the pole piece a voltage is created in the magnetic field of the pick-up coil.

The pick-up coil sends this voltage signal to the electronic module, which determines from RPM when to start current building in the primary windings of the ignition coil.

Each time the timer core teeth align with the pole piece teeth the pick-up coil magnetic field is changed creating a different voltage. The pick-up coil sends this different voltage signal to the electronic module which electronically shuts off the ignition coil primary circuit. This in turn collapses the coil magnetic field, induces high secondary voltage and fires one spark plug.

The electronic module delivers full battery voltage to the ignition coil which is limited to five to six amperes. There is no primary resistance wire in the HEI system. The electronic module triggers the closing and opening of the primary circuit instantaneously with no energy lost due to breaker point arcing or capacitor charging time lag. The capacitor in the HEI unit functions only as a radio noise suppressor.

This instantaneous and efficient circuit triggering enables the HEI system to deliver up to approximately 35,000 volts through the secondary wiring to the spark plugs.

Because of the higher voltage the HEI system has larger diameter (8 millimeter) spark plug wires with silicone insulation. The silicone wire is gray in color, more heat resistant than standard black wire and less vulnerable to deterioration. Silicone insulation is soft, however, and must not be mishandled.

DIAGNOSIS

Analyzing H.E.I. System Conditions

Careful adherence to the following procedures will lead to the location and correction of High Energy Ignition system problems.

Normally only a portion of the procedures need be performed.

Before starting the detailed procedure:

1. Make sure that wiring connector is properly attached to connector at side of distributor cap.
2. Make sure that all spark plug leads are properly connected at plugs and at distributor terminals.

Trouble in the ignition system will show up as one of the following conditions:

a. Engine will not start.
b. Engine starts but runs roughly.

a. Engine will not start

1. Connect voltmeter between "BAT" terminal lead on distributor connector and ground.
2. Turn ignition switch ON.
3. If voltage is zero, there is an open circuit in the 18 pink wire between the distributor and the bulkhead connector; or in the 12 pink wire between the bulkhead connector and the ignition switch; or in the 10 red wire between the ignition switch and the starter solenoid. Repair as required.
4. If reading is battery voltage, hold one spark plug lead with insulated pliers approximately 1/4 inch away from a dry area of engine block while cranking engine.
5. If sparking occurs, trouble is not in distributor. Check spark plugs. Refer to page 6-62 for fuel system diagnosis.
6. If sparking does not occur, proceed to Part c of this Note.

b. Engine Starts But Runs Roughly

1. Check for proper fuel delivery.
2. Check all vacuum hoses for leakage.
3. Visually inspect and listen for sparks jumping to ground or to other plug wires.
4. Check ignition timing.
5. Check centrifugal advance mechanism for proper operation.
6. Remove all spark plugs and check for malfunctions such as improper gap, fouling, cracked insulators (inside and out), etc.
7. If no malfunctioning are found, proceed to Part c.

c. Component Checks

1. Remove cap and coil assembly by removing wiring harness connector and battery lead and turning four cap to housing latches.
2. Inspect cap and coil assembly and rotor for spark arc-over.
3. Connect ohmmeter with one lead to the "BAT" terminal and the second lead to the "TACH" terminal as shown in position 1 of Fig. 6-37.
4. Reading should be zero or nearly zero. If not, replace coil.

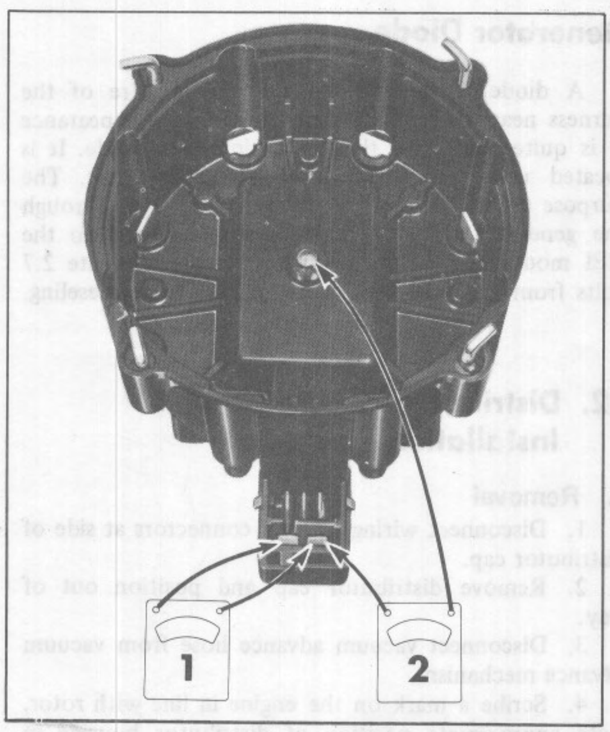


Fig. 6-37 Checking HEI Ignition Coil

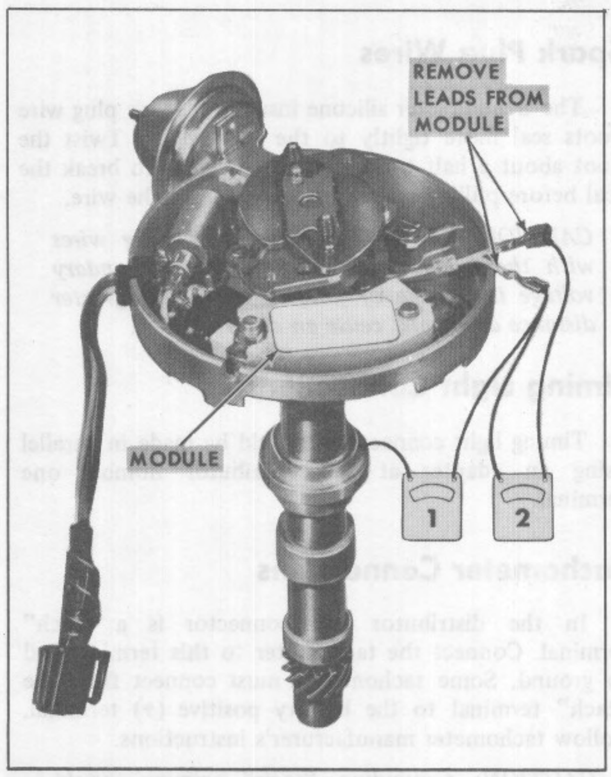


Fig. 6-38 Checking HEI Pickup Coil

5. Connect ohmmeter with one lead to the "TACH" terminal and the second lead to the coil secondary output terminal as shown in position 2 of Fig. 6-37. Use middle or high scale.

6. Reading should not be infinite. If reading is infinite, replace coil.

7. Connect J-23738 vacuum tester to vacuum advance unit.

8. Disconnect pick-up coil leads from "W" and "G" terminals of module.

9. Connect ohmmeter with one lead to ground and the second lead to a pick-up coil lead as shown in position 1 of 6-38. Use middle scale.

10. Operate vacuum tester and observe ohmmeter throughout vacuum range.

11. Reading should be infinite at all times. If not, replace pick-up coil.

12. Disconnect ohmmeter lead from pick-up coil lead and connect it to the second pick-up coil lead.

13. Repeat steps 10 and 11.

14. Repeat Steps 9 and 10 with ohmmeter connected with one lead to each of the pick-up coil lead wires as shown in position 2 of Fig. 6-38.

15. If ohmmeter reads less than 650 ohms, or more than 850 ohms, at any time, replace pickup coil.

16. If no malfunctions have been found, replace module.

SERVICE INFORMATION

The HEI system is designed to be free from routine maintenance. If component part replacement should become necessary, however, several items specific to the HEI system should be noted.

Electronic Module

The electronic module is serviced by complete replacement only. When replacing the module a liberal coating of special silicone grease must be applied to the metal mounting surface on which the module will be installed. If this grease is not applied the module will not cool properly which can cause the module to malfunction. A tube of this special silicone grease is supplied with each replacement module.

Spark Plug Wires

The 8 millimeter silicone insulation spark plug wire boots seal more tightly to the spark plugs. Twist the boot about a half turn in either direction to break the seal before pulling on the boot to remove the wire.

CAUTION: Do NOT remove spark plug wires with the engine running. The higher secondary voltage is capable of jumping an arc of greater distance and could cause an electric shock.

Timing Light Connections

Timing light connections should be made in parallel using an adapter at the distributor number one terminal.

Tachometer Connections

In the distributor cap connector is a "tach" terminal. Connect the tachometer to this terminal and to ground. Some tachometers must connect from the "tach" terminal to the battery positive (+) terminal. Follow tachometer manufacturer's instructions.

CAUTION: Grounding "tach" terminal could damage the H.E.I. electronic module.

Other Test Equipment

Oscilliscopes require special adaptors. Distributor machines require a special amplifier. The equipment manufacturers have instructions and details necessary to modify test equipment for HEI diagnosis.

Vacuum and Centrifugal Advance Specifications

Vacuum and centrifugal advance specifications are the same as for corresponding standard ignition distributors as listed on Fig. 6-28.

Generator Diode

A diode is included in the brown wire of the harness near the generator tell tale lamp. In appearance it is quite similar to the starter interlock diode. It is located near the top of the radio heat sink. The purpose of the diode is to prevent feed back through the generator tell tale lamp brown lead wire to the HEI module. Without the diode the approximate 2.7 volts from this feed back would cause engine dieseling.

42. Distributor Removal and Installation

a. Removal

1. Disconnect wiring harness connectors at side of distributor cap.

2. Remove distributor cap and position out of way.

3. Disconnect vacuum advance hose from vacuum advance mechanism.

4. Scribe a mark on the engine in line with rotor. Note approximate position of distributor housing in relation to engine.

5. Remove distributor hold-down nut and clamp.
6. Lift distributor from engine.

b. Installation

1. Install distributor using same procedure as for standard distributor.
2. Install distributor hold-down clamp and snugly install nut.
3. Move distributor housing to approximate position relative to engine noted during removal.
4. Position distributor cap to housing with tab in base of cap aligned with notch in housing and secure with four latches.
5. Connect wiring harness connector to terminals on side of distributor cap. Connector will fit only one way.
6. Adjust ignition timing to 10° B.T.D.C. using the procedure described in Note 38.

43. Distributor Disassembly and Assembly

a. Disassembly

1. Remove distributor as described in note 42a.
2. Remove rotor from distributor shaft by removing two screws.
3. Remove two advance springs, weight retainer, and advance weights.
4. Remove two screws holding module to housing and move module to a position where connector may be removed from "B" and "C" terminals.
5. Remove wires from "W" and "G" terminals of module.
6. Remove roll pin from drive gear.

CAUTION: Distributor gear should be supported in such a way that no damage will occur to distributor shaft while removing pin.

7. Remove gear, shim and tanged washer from distributor shaft. Remove any burrs that may have been caused by removal of pin.
8. Remove distributor shaft from housing.
9. Remove washer from upper end of distributor housing.
10. Remove three screws securing pole piece to housing and remove pole piece, magnet and pick-up coil.
11. Remove lock ring at top of housing and remove pick-up coil retainer, shim and felt washer.

(NOTE: No attempt should be made to service the shaft bushings in the housing.)

12. Remove vacuum advance mechanism by removing two screws.
13. Disconnect capacitor lead and remove capacitor by removing one screw.
14. Remove wiring harness from distributor housing.

b. Assembly

1. Position vacuum advance unit to housing and secure with two screws.
2. Position felt washer over lubricant reservoir at top of housing.
3. Position shim on top of felt washer.
4. Position pick-up coil retainer to housing with vacuum advance arm over actuating pin of vacuum advance mechanism. Secure with lock ring.
5. Install pick-up coil magnet and pole piece. Loosely install three screws holding pole piece.
6. Install washer to top of housing.
7. Install distributor shaft and rotate to check for even clearance all around between pole piece and shaft projections.
8. Move pole piece to provide even clearance and secure with three screws.
9. Install tanged washer, shim and drive gear (teeth up) to bottom of shaft. Align drive gear and install new roll pin.
10. Position capacitor to housing and loosely install one mounting screw.
11. Install connector to "B" and "C" terminals on module with tab on top.
12. Apply special silicone lubricant liberally to bottom of module and secure with two screws.
13. Position wiring harness with grommet in housing notch.
14. Connect pink wire to capacitor stud, and black wire to capacitor mounting screw. Tighten screw.
15. Connect white wire from pick-up coil to terminal "W" of module.
16. Connect white with green stripe wire from pick-up coil to terminal "G" of module.
17. Install centrifugal advance weights, weight retainer (dimple facing down), and springs.
18. Install rotor and secure with two screws.

CAUTION: Notch on side of rotor must engage tab on cam weight base.

19. Install distributor as described in Note 42b.

44. Ignition Coil

a. Removal

1. Disconnect battery wire and harness connector from distributor cap.
2. Remove three screws securing coil cover to distributor cap.
3. Remove four screws securing ignition coil to distributor cap.
4. Remove ground wire from coil.
5. Push coil leads from under side of connectors and remove coil from distributor cap.

b. Installation

1. Position coil into distributor cap with terminals over connector at side of cap.
2. Push coil lead wires into connector on side of cap as follows: black (ground) in center; brown next to vacuum advance unit; pink opposite vacuum advance unit.
3. Secure ignition coil with four screws. Place ground wire under coil mounting screw.
4. Install coil cover onto distributor cap and secure with three screws.

THEORY OF OPERATION

Generator

A 42 ampere generator is used without air conditioning, and a 63 ampere generator with air conditioning. An 80 ampere generator is included on all cars equipped with the Trailer Towing package and is also available as a heavy duty option.

The limousine and commercial chassis use the 80 ampere generator as standard equipment. The optional 145 ampere heavy duty generator for commercial chassis only will be covered later in this section, page 6-37.

These generators illustrated in Fig. 6-39 feature a solid state regulator that is mounted inside the generator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

The generator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the generator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the generator output terminal. Generator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noise.

No periodic adjustments or maintenance of any kind are required on the entire generator assembly.

A wiring circuit diagram is illustrated in Fig. 6-40. The basic operating principles are explained as follows.

When the switch is closed, current from the battery flows through the indicator lamp to the generator No. 1 terminal, through resistor R1, diode D1, and the base-emitter of transistor TR1 to ground, and then back to the battery. This turns on transistor TR1, and current flows through the generator field coil and TR1 back to the battery. The resistor in parallel with the indicator lamp reduces total circuit resistance to provide higher field current for initial voltage build-up when the engine starts.

With the generator operating, a.c. voltages are generated in the stator winding, and the stator supplies d.c. field current through the diode trio, the field, TR1 and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the generator "BAT" terminal. As generator speed increases, current is provided for charging the battery and operating electrical accessories. Also, with the generator operating,

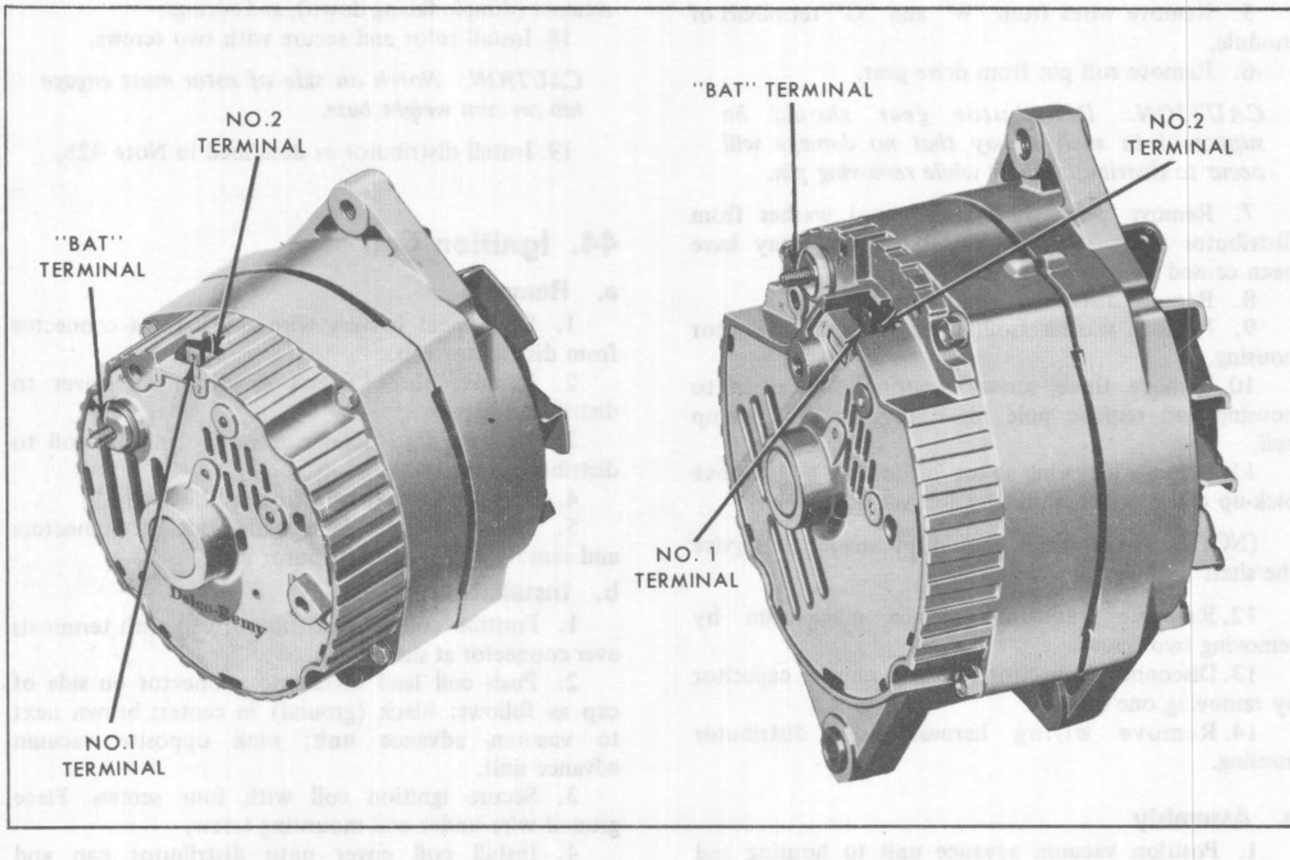


Fig. 6-39 Generators

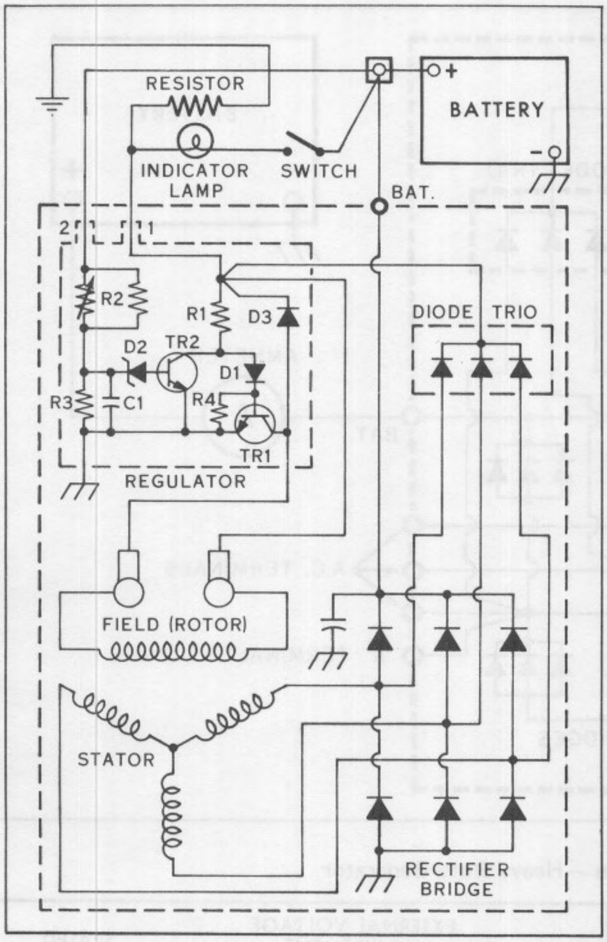


Fig. 6-40 Basic Charging Circuit

the same voltage appears at the "BAT" and No. 1 terminals, and the indicator lamp goes out to indicate the generator is producing voltage.

The No. 2 terminal on the generator is always connected to the battery but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the generator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the generator voltage to a preset value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D3 prevents high-induced-voltages in the field windings when TR1 turns off. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

Generator (With H.D. Generator)

The optional heavy duty integral charging system for the Commercial Chassis is illustrated in Fig. 6-41 and features a solid state regulator that is mounted inside the

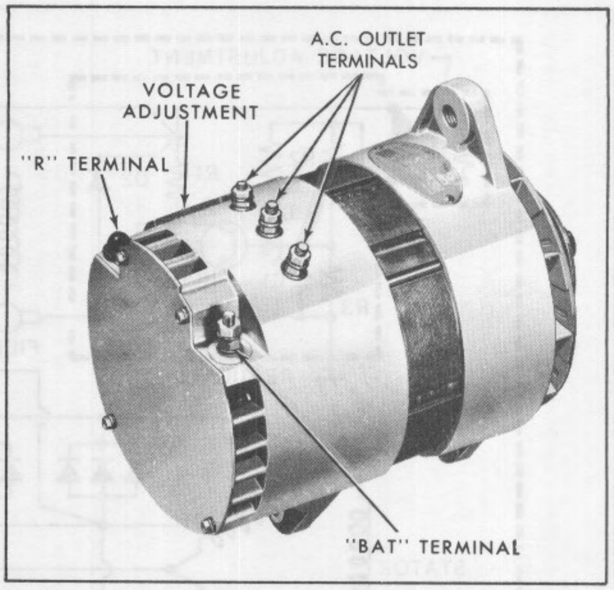


Fig. 6-41 Heavy Duty Generator

slip ring end frame. The regulator voltage setting can be adjusted externally by repositioning a voltage adjustment cap in the slip ring end frame. This feature is covered in detail in Fig. 6-48. Only one wire is needed to connect the Integral Charging System to the battery, along with an adequate ground return. To operate auxiliary equipment, three a.c. terminals are provided to which a transformer-rectifier combination may be connected for conversion to 110 volts d.c.

The rotor bearing in the slip ring end frame contains a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. The drive end frame bearing is sealed on both sides and is serviced by complete replacement. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the frame. Rectifier bridges connected to the stator windings each contain six diodes, and electrically change the stator a.c. voltages to a d.c. voltage which appears at the output terminal. Field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridges and diode trio from high voltages, and suppresses radio noise.

The internal wiring diagram is illustrated in Fig. 6-42. The basic operating principles are explained as follows.

With the Integral Charging System operating, a.c. voltages initially are generated in the stator windings by residual magnetism in the rotor. Current then flows through the diode trio, resistor R1, and resistor R4 to turn transistor TR1 on. The stator then supplies d.c. field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridges back to the stator. Also, the diodes in the rectifier bridges change the stator a.c. voltages to a d.c. voltage which appears between ground and the "BAT" terminal.

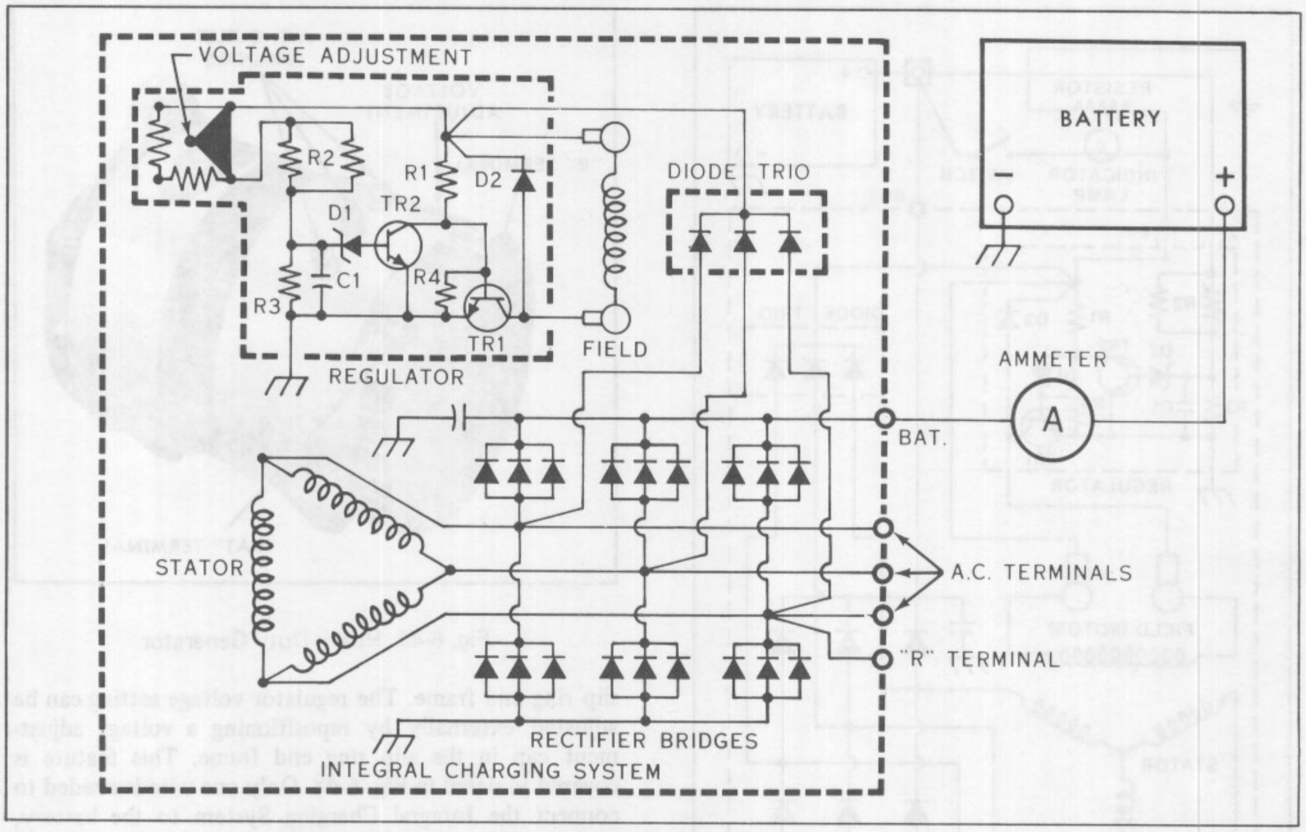


Fig. 6-42 Internal Wiring Diagram – Heavy Duty Generator

As speed increases, current is provided for charging the battery and operating electrical accessories.

As the speed and voltage increase, the voltage between R2 and R3 increases to the value where zener diode D1 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D1 then blocks current flow causing TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the voltage to the adjusted value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D2 prevents high-induced-voltages in the field windings when TR1 turns off.

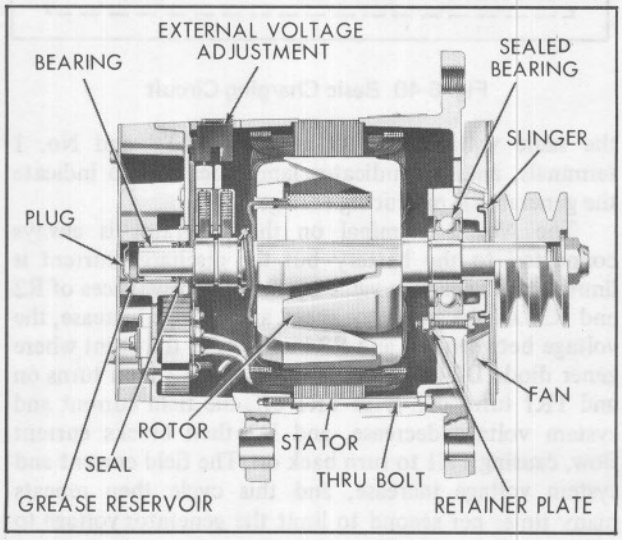


Fig. 6-43 Cutaway View of Heavy Duty Generator

DIAGNOSIS CHARGING SYSTEM

45. Analyzing Charging System Troubles

Close adherence to the following procedures in the order presented will lead to the location and correction of integral charging system defects in the shortest possible time. Only a portion of these procedures need be performed. It will seldom be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Fig. 6-44. To avoid damage to the electrical equipment, always observe the following precautions:

- Do not polarize the generator.
- Do not short across or ground any of the terminals

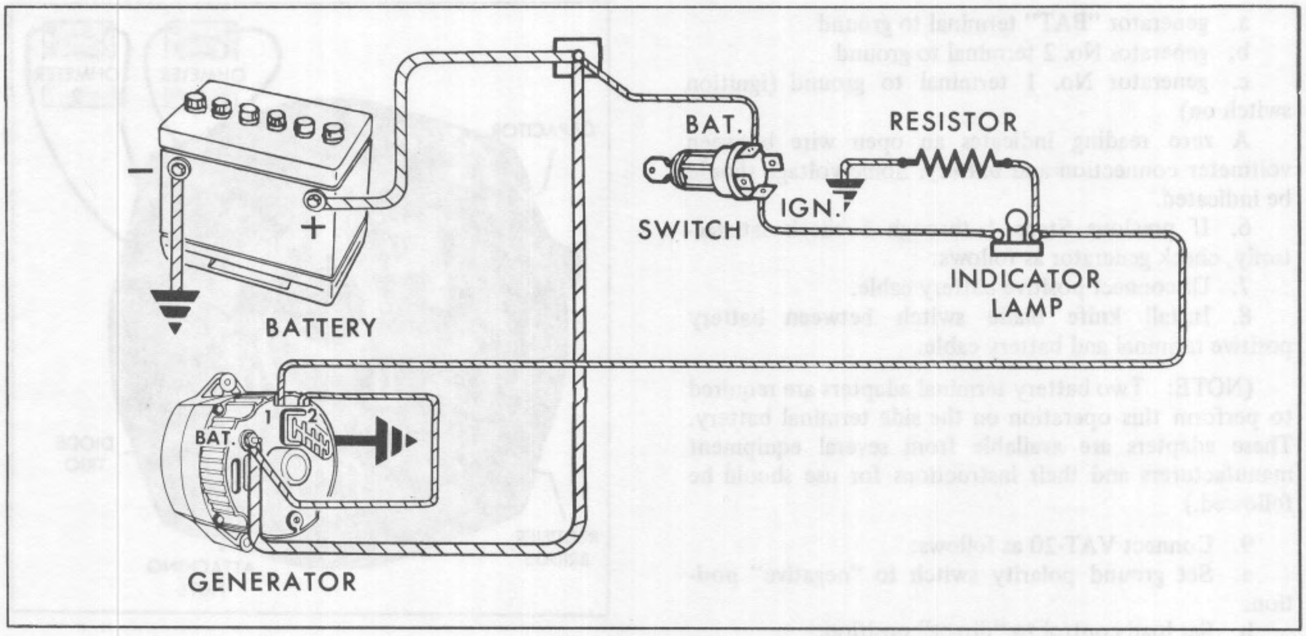


Fig. 6-44 Basic Charging System Wiring Diagram

in the charging circuit except as specifically instructed herein.

- NEVER operate the generator with the output terminal open-circuited.
- Make sure the generator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

A. Faulty indicator lamp operation.

B. An undercharged battery as evidenced by slow cranking and low specific gravity readings.

C. An overcharged battery as evidenced by excessive water usage.

a. Faulty Indicator Lamp Operation

Check the indicator lamp for normal operation as shown below.

Switch	Lamp	Engine
OFF	OFF	STOPPED
ON	ON	STOPPED
ON	OFF	RUNNING

If the indicator lamp operates normally, proceed to "Undercharged battery" or "Overcharged battery" section. Otherwise, proceed to either one of the following three abnormal conditions.

1. Switch Off, Lamp On—In this case, disconnect the two leads from the generator No. 1 and No. 2 terminals. If the lamp stays on, there is a short between these two leads. If the lamp goes out, replace the rectifier bridge as described in Note 47c. This condition will cause an undercharged battery.

2. Switch On, Engine Stopped, Lamp Off—This condition can be caused by a blown (5 AMP) "Gage" fuse, a burned out light bulb, malfunctioning socket or an open in one of the following wires, (12 Pink) wire between the ignition switch and the gage fuse; the (18 pink) wire between the fuse and the light bulb or the (16 brn.) wire between the bulb and the bulk head connector. A malfunctioning diode (open condition) on cars equipped with High Energy Ignition will cause the bulb not to glow.

3. Switch On, Engine Running, Lamp On—This condition is most likely caused by a broken fan belt. Check to make sure the No. 1 and No. 2 leads at the generator are correctly installed.

If the above conditions are OK, the problem is inside the generator. Disassemble and test the following components as described in note 49; rectifier bridge stator, field winding and diode trio. If no malfunction is found replace the regulator.

b. Undercharged Battery

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions even though the indicator lamp may be operating normally.

1. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.
2. Check the drive belt for proper tension.
3. If a battery malfunction is suspected, refer to battery diagnosis, Notes 11 through 14.
4. Inspect the wiring. Check all connections for tightness and cleanliness, including the slip connectors at the generator and firewall, and the cable clamps and battery terminals and starter solenoid.
5. With all wiring harness leads connected, connect a voltmeter from:

a. generator "BAT" terminal to ground
b. generator No. 2 terminal to ground
c. generator No. 1 terminal to ground (ignition switch on)

A zero reading indicates an open wire between voltmeter connection and battery. Some voltage should be indicated.

6. If previous Steps 1 through 5 check satisfactorily, check generator as follows:
7. Disconnect positive battery cable.
8. Install knife blade switch between battery positive terminal and battery cable.

(NOTE: Two battery terminal adapters are required to perform this operation on the side terminal battery. These adapters are available from several equipment manufacturers and their instructions for use should be followed.)

9. Connect VAT-20 as follows:
a. Set ground polarity switch to "negative" position.
b. Set load control to "direct" position.
c. Connect BAT lead of ammeter to knife blade switch terminal stud and connect REG lead to positive battery cable on the knife blade switch.
d. Connect ammeter GRD terminal to negative battery terminal.
10. Disconnect the feed wire from the heater or A/C blower motor.
11. Close knife blade switch and start engine.
12. Turn off all accessories and close car doors.
13. Open knife blade switch and raise engine speed to approximately 2000 RPM.
14. Adjust load control for highest ammeter reading.
15. If ampere output is within 10 percent of rated output as stamped on generator frame, generator is not malfunctioning; recheck Steps 1 through 5.

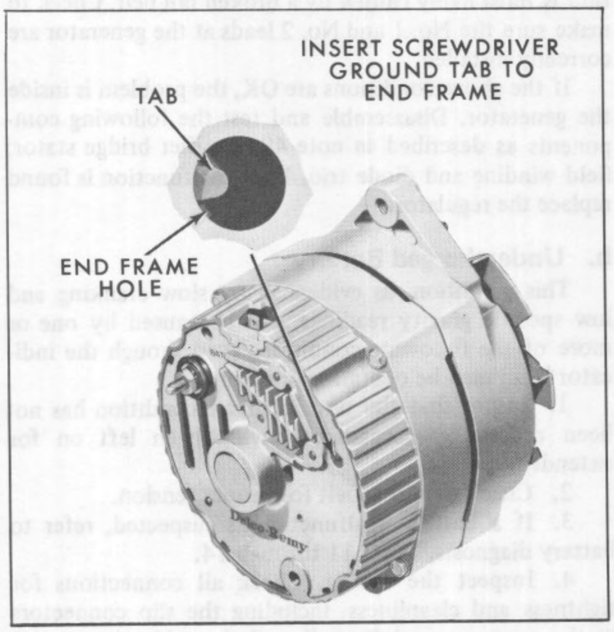


Fig. 6-45 Grounding Generator Field Winding

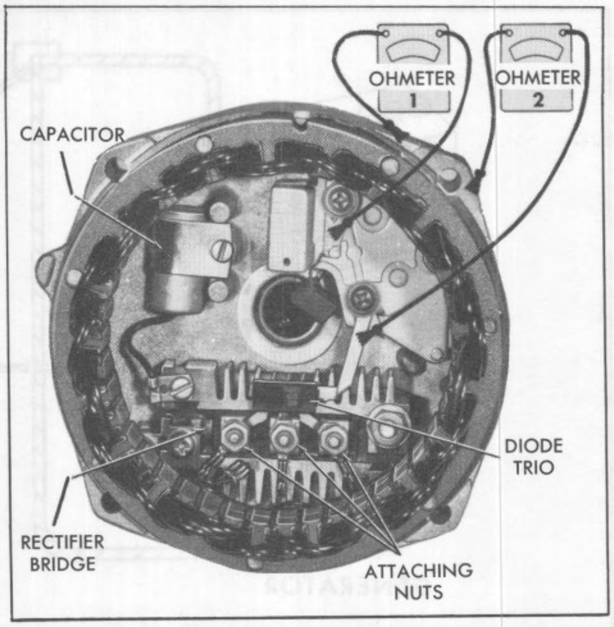


Fig. 6-46 Slip Ring End Frame Assembly

16. If ampere output is not within 10 percent of rated output, ground the field winding by inserting a screwdriver into the test hole, Fig. 6-45.

CAUTION: Tab is within 3/4 inch of casting surface. Do not force screwdriver deeper than one inch into end frame.

17. Operate engine at approximately 2000 RPM and adjust load control as required to obtain maximum current output.
18. If output is within 10 percent of rated output, replace regulator as described in Note 49e.
19. If output is not within 10 percent of rated output, check the field winding, diode trio, rectifier bridge, and stator as described in Note 49.
20. Turn off engine and remove equipment from vehicle.

c. Overcharged Battery

If battery checks good, but an obvious overcharge condition exists as evidenced by excessive battery water usage (more than one ounce per cell per month), proceed as follows:

1. Separate end frames as described in Note 48a. Check Field winding for shorts. If shorted (0 reading) replace rotor and regulator.
2. Connect ohmmeter using lowest range scale from brush lead clip to end frame as shown in Step 1, Fig. 6-46, then reverse lead connections.
3. If both readings are zero, either the brush lead clip is grounded or regulator is malfunctioning.
4. A grounded brush lead clip can result from omission of insulating washer, Fig. 6-46, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as described in Note 49e.

DIAGNOSIS
CHARGING SYSTEM (WITH H. D. GENERATOR)

46. Analyzing Charging System Trouble

Close adherence to the following procedures in the order presented will lead to the location and correction of charging system malfunctions in the shortest possible time. Only a portion of these procedures need be performed. It will seldom be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Fig. 6-47. To avoid damage to the electrical equipment always observe the following precautions:

- Do not polarize the Integral Charging System.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed herein.
- Make sure the Integral Charging System and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle battery, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

a. Undercharged Battery

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions:

1. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.
2. Check the drive belt for proper tension.
3. If a battery malfunction is suspected, proceed with checks.
4. Inspect the wiring. Check all connections for tightness and cleanliness, including the cable clamps and battery posts.
5. Connect a voltmeter from "BAT" terminal on Integral Charging System to ground. A zero reading indicates an open between voltmeter connection and battery.
6. If previous Steps 1 through 5 check satisfactorily, check Integral Charging System as follows:
7. Disconnect positive battery cable.
8. Install knife blade switch between battery positive post and battery cable terminal.
9. Connect VAT-20 tester as follows:
   a. Set ground polarity switch to negative position.
   b. Set load control to direct position.

Connect BAT lead of ammeter to knife blade switch terminal stud and connect REG lead to positive battery cable on the knife blade switch.

d. Connect ammeter GRD terminal to negative battery terminal.

10. On air conditioned cars, disconnect the 18T wire from the blower motor.
11. Close knife blade switch and start engine.
12. Turn off all accessories and close car doors.

CAUTION: The following specifications are critical and given values must be adhered to.

13. Open knife blade switch and raise engine speed to 750 rpm.

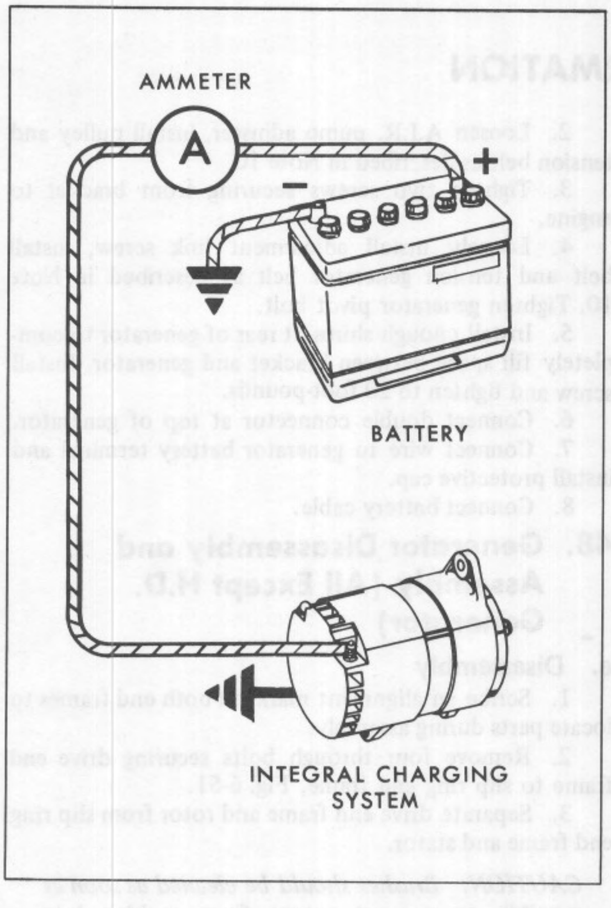


Fig. 6-47 Wiring Diagram – Heavy Duty Generator

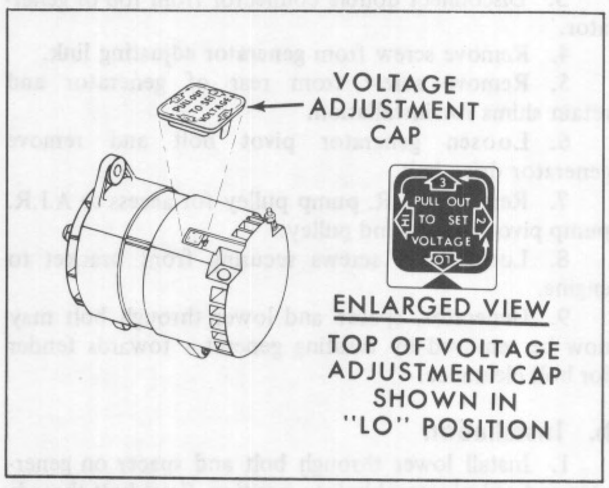


Fig. 6-48 Voltage Adjustment Cap

14. Adjust load control for highest ammeter reading.

15. Reading should be 95 amps. plus or minus 10 percent.

CAUTION: In no case should engine speed go above 750 rpm as generator is capable of producing 145 to 150 amps and will destroy ammeter.

16. If reading given in Step 15 is correct, generator is functioning normally. In this case, an adjustment of the voltage setting may correct the undercharged condition. Raise the setting by removing the voltage adjusting cap, rotating in increments of 90°, and then re-inserting the cap in the connector body. As illustrated in Fig. 6-48, the cap is set for low voltage. With position 2 aligned with the arrow, the setting is increased to medium low, position 3 is medium high, and position "HI" is the highest regulator setting. After adjusting the setting, check for an improved battery condition after a service period of reasonable length, such as one week.

(NOTE: The voltage adjustment in Fig. 6-48, is for purposes of illustration only. The actual adjustment as shipped from the factory may be in some other position such as position 3, depending on the application requirement.)

(NOTE: High underhood temperatures may cause amperage reading to be slightly lower than rated.)

17. If reading obtained is not correct, record amps for future reference and remove generator for repair as described in Note 50.

b. Overcharged Battery

1. Check the battery. Remember that an overheated battery will be overcharged even though no charging circuit defects are present.

2. If battery is not defective or overheated, connect a voltmeter between Integral Charging System "BAT" terminal and ground.

3. With all accessories turned off, increase engine speed as required to obtain maximum voltage reading.

4. If voltage exceeds 15 volts, remove Integral Charging System for repair as described in Note 50.

5. If voltage does not exceed the values listed in Step 4 preceding, adjust voltage to a lower value by removing voltage adjusting cap and re-inserting into connector body. Then check battery condition after a service period of reasonable length, such as one week. Fig. 6-48 is for purposes of illustration only, and shows the cap adjusted for the lowest setting. The actual adjustment as shipped from the factory may be in some other position, such as position 3, depending on the application requirement. The lowest setting is with "LO" aligned with the arrow, position 2 is medium low, position 3 is medium high, and "HI" is the highest setting.

SERVICE INFORMATION

47. Generator Removal and Installation (Except H.D. Generator) (Fig. 6-49)

a. Removal

1. Raise hood and disconnect negative battery cable.

2. Remove protective cap from generator battery terminal and remove wire from terminal.

3. Disconnect double connector from top of generator.

4. Remove screw from generator adjusting link.

5. Remove screw from rear of generator and retain shims for installation.

6. Loosen generator pivot bolt and remove generator drive belt.

7. Remove A.I.R. pump pulley for access to A.I.R. pump pivot bolt behind pulley.

8. Loosen two screws securing front bracket to engine.

9. Generator, spacer and lower through bolt may now be removed by twisting generator towards fender for bolt clearance.

b. Installation

1. Install lower through bolt and spacer on generator and swivel assembly into position. Start bolt threads into rear bracket.

2. Loosen A.I.R. pump adjuster, install pulley and tension belt as described in Note 10.

3. Tighten two screws securing front bracket to engine.

4. Loosely install adjustment link screw, install belt and tension generator belt as described in Note 10. Tighten generator pivot bolt.

5. Install enough shims at rear of generator to completely fill space between bracket and generator. Install screw and tighten to 20 foot-pounds.

6. Connect double connector at top of generator.

7. Connect wire to generator battery terminal and install protective cap.

8. Connect battery cable.

48. Generator Disassembly and Assembly (All Except H.D. Generator)

a. Disassembly

1. Scribe an alignment mark on both end frames to locate parts during assembly.

2. Remove four through bolts securing drive end frame to slip ring end frame, Fig. 6-51.

3. Separate drive end frame and rotor from slip ring end frame and stator.

CAUTION: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

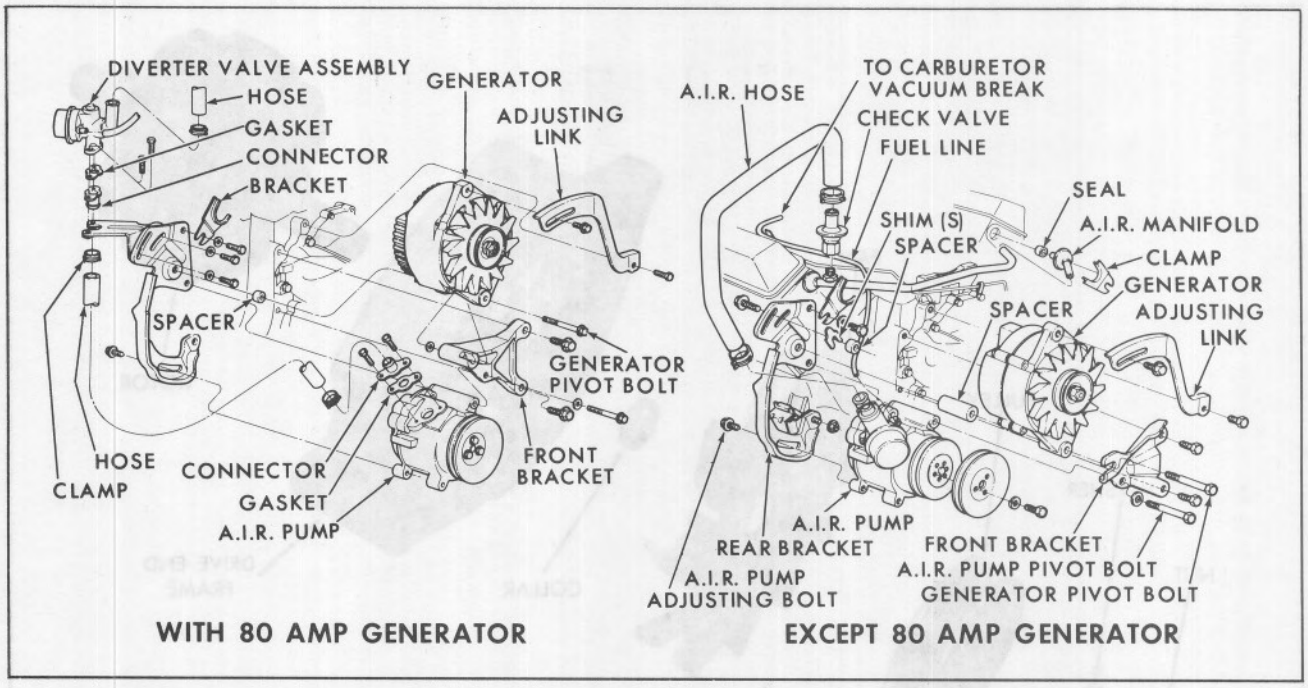


Fig. 6-49 Generator Attaching Parts

4. Remove brush springs which will now be loose.

5. Place a piece of tape (pressure sensitive tape, not friction tape) over the slip ring end bearing and the bearing shaft on the rotor.

6. Remove three nuts holding stator leads to rectifier bridge and remove stator.

7. Remove one screw with plastic insulator holding diode trio to brush holder and remove diode trio.

8. Remove screws securing regulator and brush holder. Remove brush holder and regulator.

9. Remove rectifier bridge by removing the following fasteners: one screw with washer; one screw at capacitor lead; one nut and washer from "BAT" terminal stud.

10. Remove insulator and "BAT" terminal stud.

11. Remove one screw securing capacitor to end frame and remove capacitor.

12. To remove rotor from drive end frame, install rotor in a vise and tighten only enough to permit removal of shaft nut.

CAUTION: Avoid excessive tightening as this may cause distortion of the rotor.

13. Remove shaft nut, washer, pulley, fan and collar. Separate end frame from rotor.

b. Assembly

1. Position "BAT" terminal stud in end frame with molded plastic insulator outside and fiber insulator inside.

2. Position rectifier bridge to end frame and secure with nut and washer at one end and screw with washer at opposite end.

3. Install capacitor and secure to end frame and heat sink with screws, Fig. 6-50.

4. Position regulator in slip ring end frame. Position brush holder over regulator. Do not install mounting screws.

5. Position diode trio on rectifier bridge and secure to regulator with insulated screw, Fig. 6-50.

6. Secure regulator and brush holder to end frame with insulated and non-insulated screws as shown in Fig. 6-50.

7. Position stator to end frame with leads over rectifier bridge studs and secure with three nuts.

8. Install brush springs and brushes in brush holder and insert a straight wire or pin through hole in end

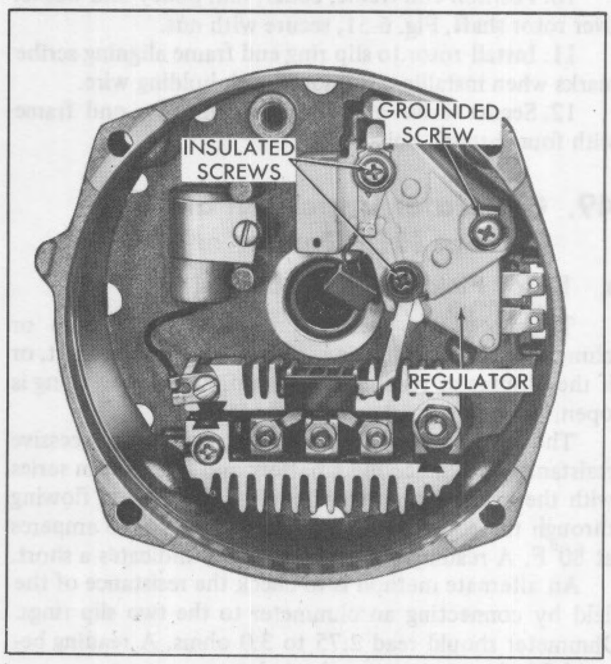


Fig. 6-50 Regulator Attaching Screw Location

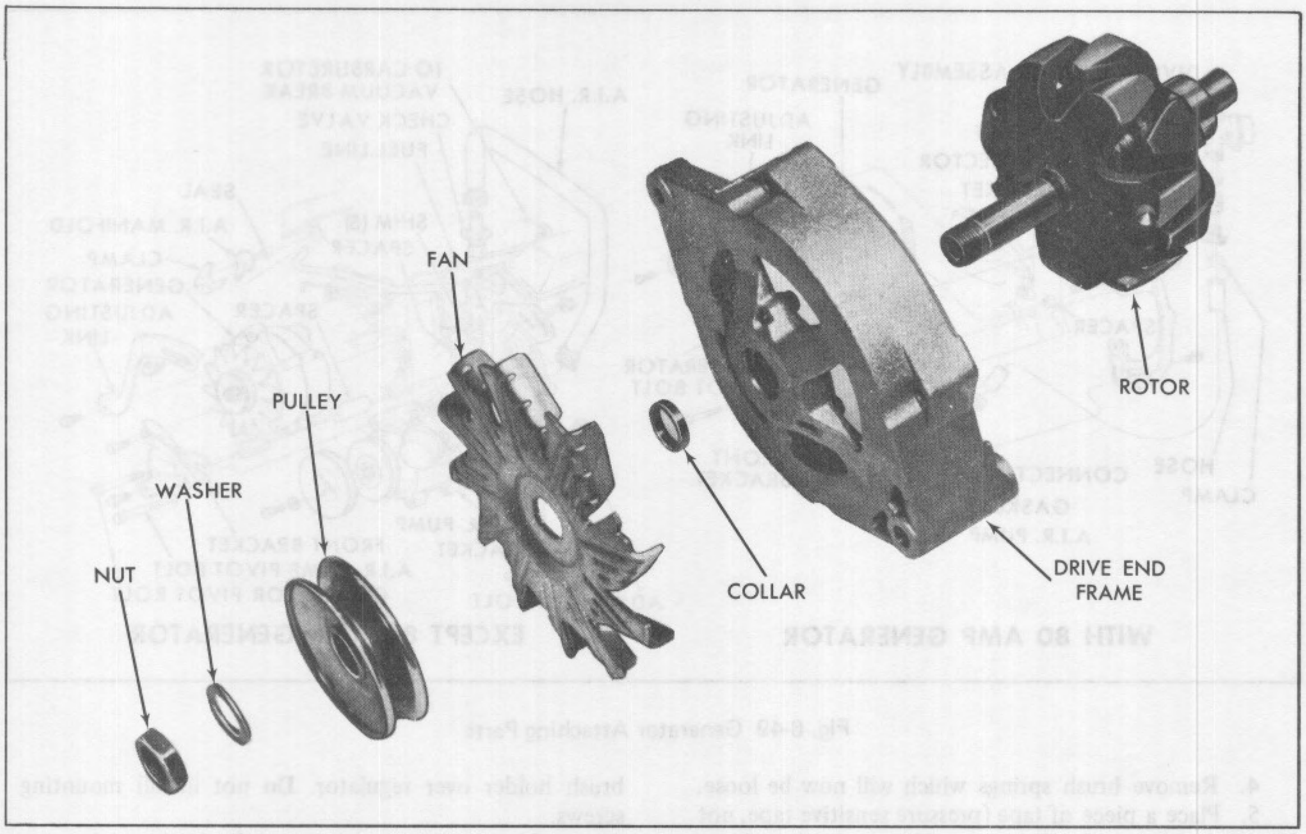


Fig. 6-51 Rotor and Drive End Frame

frame and holes in bottom of brush holder. This will hold brushes until rotor is assembled into frame.

9. Install rotor in vise with drive end up. Tighten vise firm but not tight.

CAUTION: Avoid excessive tightening as this may cause distortion of the rotor.

10. Position end frame, collar, fan, pulley and washer over rotor shaft, Fig. 6-51, secure with nut.

11. Install rotor to slip ring end frame aligning scribe marks when installing. Remove brush holding wire.

12. Secure drive end frame to slip ring end frame with four through bolts.

49. Generator Inspection and Test (Except H.D. Generator)

a. Rotor Field Winding Checks (Fig. 6-52)

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open.

The winding is checked for short circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. The current flowing through the rotor winding should be 4.0 to 4.5 amperes at 80°F. A reading above 4.5 amperes indicates a short.

An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings. Ohmmeter should read 2.75 to 3.0 ohms. A reading below 2.75 ohms indicates a shorted rotor.

Remember that the winding resistance and ammeter readings will vary slightly with winding temperature changes. If the rotor is not malfunctioning, but the generator fails to supply rated output, the problem is in the diode trio, rectifier bridge or stator.

b. Diode Trio Check

The diode trio is identified in Fig. 6-46. First, connect an ohmmeter using lowest range scale from brush lead clip to end frame as shown in Step 2, Fig. 6-46, then reverse lead connections. If both readings are the

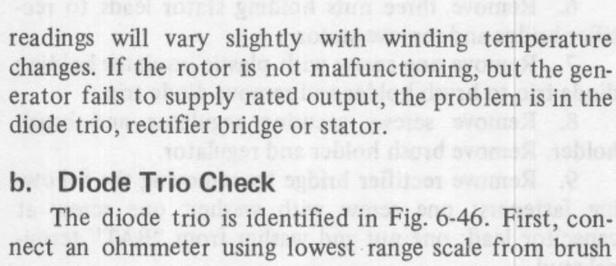


Fig. 6-52 Checking Rotor Windings

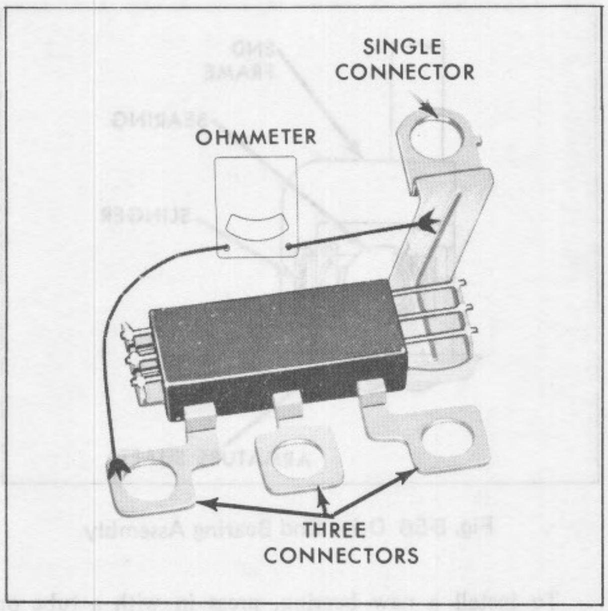


Fig. 6-53 Checking Diode Trio

same, check for grounded brush lead clip caused by omission of insulating washer Fig. 6-50, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If screw assembly is correct, and both ohmmeter readings are the same, replace regulator.

To check the diode trio, remove it from the end frame assembly by detaching the three nuts, the attaching screw, and removing the stator assembly. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Connect an ohmmeter having a 1-1/2 volt cell, and using the lowest range scale, to the single connector and to one of the three connectors Fig. 6-53. Observe the reading. Then reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors.

(NOTE: Fig. 6-46 and 6-53 illustrate two diode trios differing in appearance. Either one of these diode trios may be used in these generators, and the two are completely interchangeable.)

c. Rectifier Bridge Check

Note that the rectifier bridge has a grounded heat sink and an insulated heat sink connected to the output terminal. Also, note the insulating washer located between the insulated heat sink and end frame Fig. 6-54.

To check the rectifier bridge, connect one lead of ohmmeter to the grounded heat sink and press down very firmly onto one of the flat metal connectors and not on threaded stud with other lead. Then reverse the lead connections to the grounded heat sink and press down very firmly onto the same flat metal connector, and not on threaded stud Fig. 6-50. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat

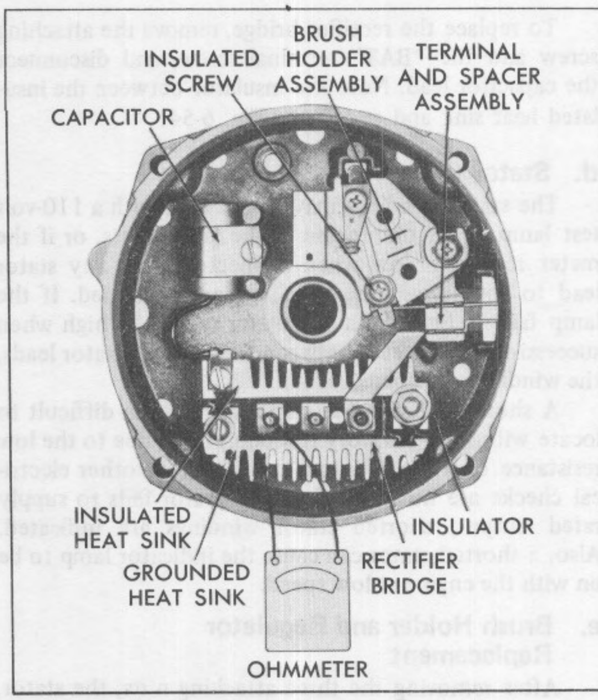


Fig. 6-54 Checking Rectifier Bridge

this same test between the grounded heat sink and the other two flat metal connectors and between the insulated heat sink and each of the three metal connectors. This makes a total of six checks, with two readings taken for each check.

The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. Do not replace either unit unless at least one pair of readings is the same.

CAUTION: Do not use high voltage to check these units. Use only ohmmeter or 12 volt test lamp.

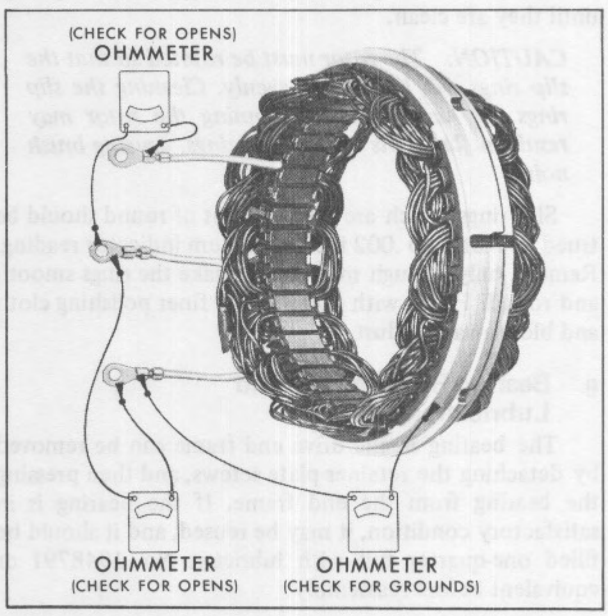


Fig. 6-55 Checking Stator Windings

To replace the rectifier bridge, remove the attaching screw and the "BAT" terminal screw, and disconnect the capacitor lead. Note the insulator between the insulated heat sink and end frame Fig. 6-54.

d. Stator Checks (Fig. 6-55)

The stator windings may be checked with a 110-volt test lamp or an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp fails to light, or if the meter reading is high when successively connected between each pair of stator leads, the windings are open.

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the generator fails to supply rated output, shorted stator windings are indicated. Also, a shorted stator can cause the indicator lamp to be on with the engine at low speed.

e. Brush Holder and Regulator Replacement

After removing the three attaching nuts, the stator, and diode trio screw Fig. 6-54 the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Fig. 6-50, and that these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not, this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled generator output. Regulators may vary in appearance but are completely interchangeable in these generators.

f. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated so that the slip rings will be cleaned evenly. Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

g. Bearing Replacement and Lubrication

The bearing in the drive end frame can be removed by detaching the retainer plate screws, and then pressing the bearing from the end frame. If the bearing is in satisfactory condition, it may be reused, and it should be filled one-quarter full with lubricant No. 1948791 or equivalent before reassembly.

CAUTION: Do not overfill, as this may cause the bearing to overheat.

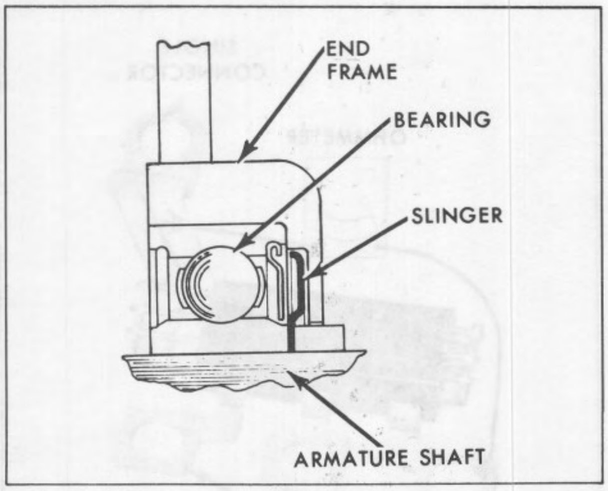


Fig. 6-56 Drive End Bearing Assembly

To install a new bearing, press in with a tube or collar that just fits over the outer race, with the bearing and slinger assembled into the end frame as shown in Fig. 6-56. It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is hardened or excessively worn. Fill the cavity between the retainer plate and bearing with 1948791 lubricant or equivalent.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing. Press from the outside of the housing towards the inside.

To install a new bearing, place a flat plate over the bearing and press in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame. Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on the bearing.

It is recommended that a new seal be installed whenever the bearing is replaced. Press the seal in with the lip of the seal toward the rotor when assembled, that is, away from the bearing. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing.

50. Generator Removal and Installation (With H.D. Generator)

a. Removal

1. Disconnect negative battery cable from battery and position out of way.
2. Disconnect all wiring connections from generator and position out of way.
3. Loosen belt tensioning pulley bolts to relieve belt tension and remove belt.
4. Remove two nuts and lock washers from lower mounting bolts, at generator, leaving bolts in place.
5. Remove bolt and lock washer from upper mounting at generator and remove generator by sliding rearward off lower mounting bolts.

b. Installation

1. Position generator to lower mounting bracket and install lower mounting bolts.
2. Install bolt and lock washer securing generator to upper mounting bracket and tighten bolt to 60 ft. lbs.
3. Install lock washers and nuts on lower mounting bolts and tighten nuts to 60 ft. lbs.
4. Position belt around generator and belt tensioning pulley and adjust belt tenison as described in Note 10b. Tighten tensioning pulley bolts to 19 foot-pounds.
5. Position wiring harness and connect to required generator terminals.
6. Position negative battery cable and connect to battery.
7. Polarize charging system by momentarily connecting a jumper wire between the generator "BAT" terminal and the generator "R" terminal.
8. Start engine and operate at 1500 RPM for 10 seconds. Generator lamp should go out.

51. Generator Disassembly and Assembly (With H.D. Generator)

a. Disassembly

1. Remove cover plate from slip ring end frame.
2. Hold rotor shaft with allen wrench while removing shaft nut. Remove washer, pulley, fan and slinger.
3. Remove four through bolts securing drive end frame to slip ring end frame and separate slip ring end frame and stator from drive end frame and rotor.

CAUTION: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

4. Separate stator from slip ring end frame by removing the nuts and washers from the three stator lead studs, Fig. 6-57.
5. Place tape over bearing and shaft to protect from dirt. Use pressure sensitive tape and not friction tape which would leave a gummy deposit.
6. Remove two remaining nuts and washers from each rectifier bridge.
7. Remove the following from the A.C. terminal studs: nut, lockwasher, flat washer insulating washer and insulating collar.
8. Remove screw with flat washer and insulator securing diode trio at brush holder and remove diode trio, A.C. leads and inner insulator.
9. Remove connector strap from each rectifier bridge.
10. Remove two nuts with internal tooth lockwashers and flat washers securing bottom rectifier bridge and remove two terminal studs.
11. Remove one screw with lock and flat washers securing bottom rectifier bridge to end frame and remove rectifier bridge.
12. To remove bridge nearest voltage adjuster, remove two screws with lock and flat washers.
13. To remove remaining rectifier bridge it is necessary to loosen the nut at the "BAT" terminal. Remove one screw with external tooth lockwasher securing "BAT" terminal lead to bridge.
14. Remove one additional screw securing bridge to end frame and remove bridge.
15. Remove two remaining screws securing brush holder and remove brush holder.
16. Remove voltage adjuster cap making note of cap position for assembly.
17. Remove one screw securing voltage regulator bracket to end frame and remove bracket and regulator.
18. Capacitor and "R" terminal lead may now be removed if desired.
19. To remove rotor from drive end frame, remove four screws from around drive end bearing and tap rotor out of housing with a soft faced hammer.
20. To remove bearings refer to Note 52i.

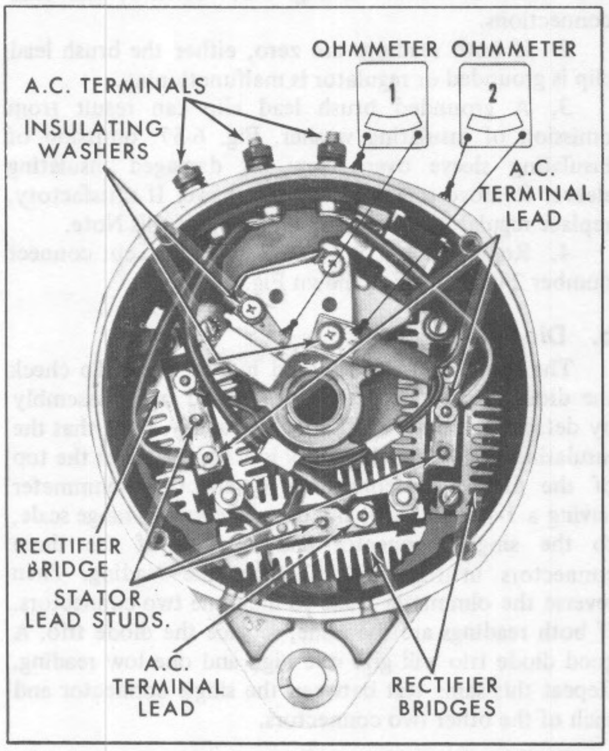


Fig. 6-57 Slip Ring End Frame (With Heavy Duty Generator)

b. Assembly (Fig. 6-58)

1. Install capacitor and "R" terminal lead if removed.
2. Position voltage regulator and adjuster to end frame. Position bracket over adjuster and secure with one screw and external tooth lockwasher.
3. Install voltage adjustment cap in same position as removed.
4. Of the three rectifier bridges, two are identical and one has an insulating sleeve at one end. Select one of the two identical ones and position under the "BAT" lead. Secure to end frame using one screw with lock and flat washers. Secure "BAT" lead to bridge using one screw with external tooth lockwasher.
5. Tighten "BAT" terminal nut.
6. Install bridge with insulator at opposite side of

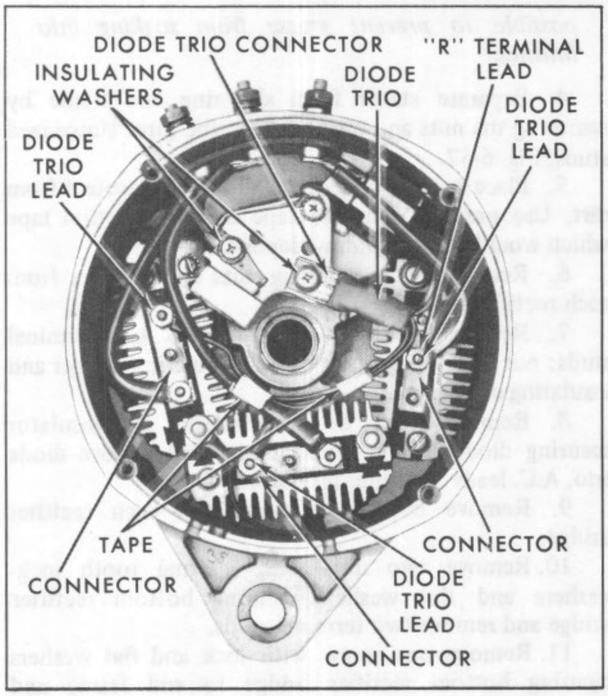


Fig. 6-58 Slip Ring End Frame Components (With Heavy Duty Generator)

end frame. Secure using two screws with lock and flat washers.

7. Position remaining rectifier bridge in end frame. Install two terminal bolts with internal tooth lockwashers. Use a flat washer at end with insulated bridge and capacitor lead at opposite end. Install but do not tighten nuts.

8. Install one screw with lock and flat washers securing bridge to end frame and tighten screw. Tighten two nuts installed in Step 7.

9. Install connector strap to each bridge.

10. Install insulator at inside of end frame for A.C. terminal studs and position diode trio and A.C. terminal leads.

11. Install insulating sleeve, insulating washer, flat washer, lockwasher and nut to each A.C. terminal. Tighten nuts.

12. Position diode trio and A.C. leads at each bridge. Secure each lead with nut and flat washer.

13. Install brush holder over voltage regulator and secure with three screws. Two screws nearest bearing have insulating washers. All screws have flat washers.

14. Install brush springs and brushes. Hold brushes. Hold brushes in position with paper clip through holder and end frame.

15. Position stator to end frame with notches in stator aligned with holes for through bolts.

16. Install stator leads to bridges at remaining open terminals. Secure with nuts and flat washers.

17. If removed, install drive end frame to rotor. Align weld nut plate and secure with four screws.

18. Remove tape from slip ring end bearing and rotor shaft. Make sure the shaft is perfectly clean after removing the tape.

19. Install rotor and drive end frame to stator and

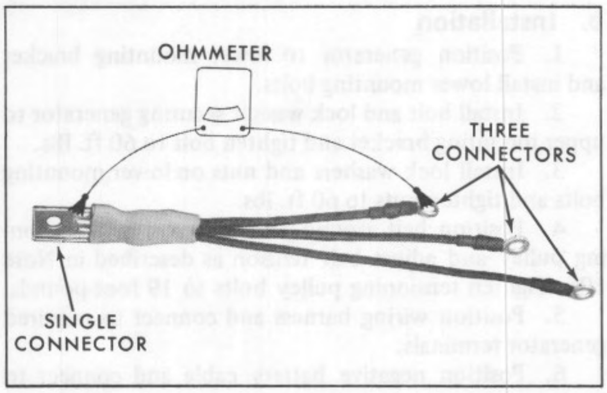


Fig. 6-59 Checking Diode Trio (With Heavy Duty Generator)

slip ring end frame after aligning mounting lugs and through bolt holes. Secure with four through bolts.

20. Remove brush holding pin and install cover plate to slip ring end frame. Secure with four screws.

21. Assemble slinger, fan, pulley, washer and nut on rotor shaft. Hold rotor shaft with an allen wrench and tighten nut to 75 foot-pounds.

52. Generator Inspection and Test (With H.D. Generator)

a. Ohmmeter Checks

1. Connect ohmmeter number 1 (having a 1-1/2 volt cell and using lowest range scale) from brush lead clip to end frame as shown in Fig. 6-57. Then reverse lead connections.

2. If both readings are zero, either the brush lead clip is grounded or regulator is malfunctioning.

3. A grounded brush lead clip can result from omission of insulating washer, Fig. 6-57, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as described in Part g of this Note.

4. Repeat Steps 1, 2 and 3 above, except connect number 2 ohmmeter as shown Fig. 6-57.

b. Diode Trio Check

The diode trio is identified in Fig. 6-58. To check the diode trio, remove it from the end frame assembly by detaching the nuts and attaching screw. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Connect an ohmmeter having a 1-1/2 volt cell, and using the lowest range scale, to the single connector and to one of the three connectors in Fig. 6-59. Observe the reading. Then reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors.

(NOTE: Diode trios differing in appearance may be specified for use in the same integral Charging System, and the two are completely interchangeable.)

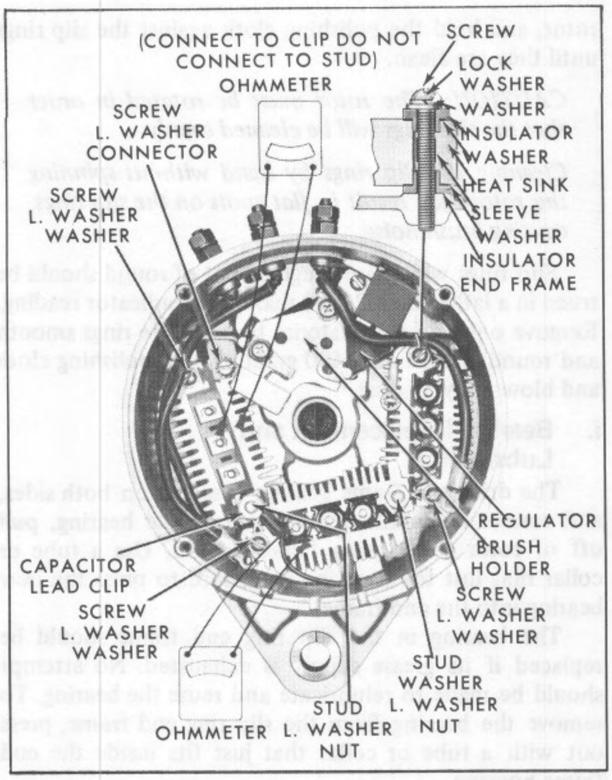


Fig. 6-60 Slip Ring End Frame Parts Position (With Heavy Duty Generator)

c. Rectifier Bridge Check

Note that each rectifier bridge has a grounded heat sink and an insulated heat sink. The insulated heat sinks are connected together, and electrically are connected to the output or "BAT" terminal. Also, note the stack-up of parts in Fig. 6-60.

To check the rectifier bridge, connect one lead of ohmmeter to a heat sink and press down very firmly onto one of the flat metal connectors and not on threaded stud with other lead. Then reverse the lead connections to the same heat sink and press down very firmly onto the same flat metal connector, and not on threaded stud Fig. 6-60. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two flat metal connectors and not on the threaded studs. This makes a total of six checks, with two readings taken for each check. Check the other two rectifier bridges in the same manner.

The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. Do not replace either unit unless at least one pair of readings is the same.

CAUTION: Do not use high voltage to check these units. Use only ohmmeter or 12 volt test lamp.

d. Rotor Field Winding Checks (Fig. 6-61)

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open.

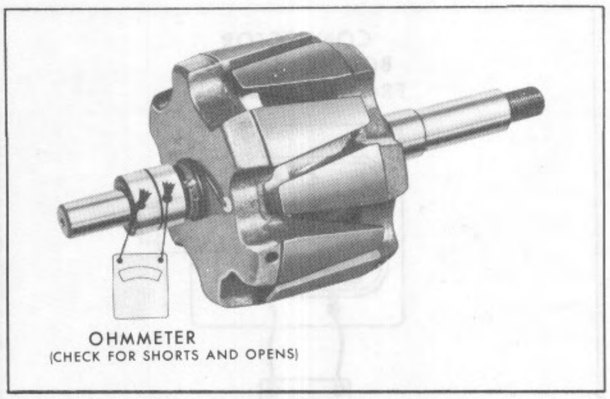


Fig. 6-61 Checking Rotor (With Heavy Duty Generator)

The winding is checked for short circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. The current flowing through the rotor winding should be 4.0 to 4.5 amperes at 80°F. A reading above 4.5 amperes indicates a short.

If the winding is shorted, replace the rotor, and the regulator as described in part g of this note.

(NOTE: Regulator replacement may have been indicated in Part a of this note.)

An alternate method is to check the resistance of the field by connecting an ahmmeter to the two slip rings. Ohmmeter should read 2.75 to 3.0 ohms. A reading below 2.75 ohms indicates shorted rotor.

Remember that the winding resistance and ammeter reading will vary slightly with winding temperature changes.

e. Stator Checks (Fig. 6-62)

The stator windings may be checked for grounds with a 110-volt test lamp or an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to a clean metal part of the frame,

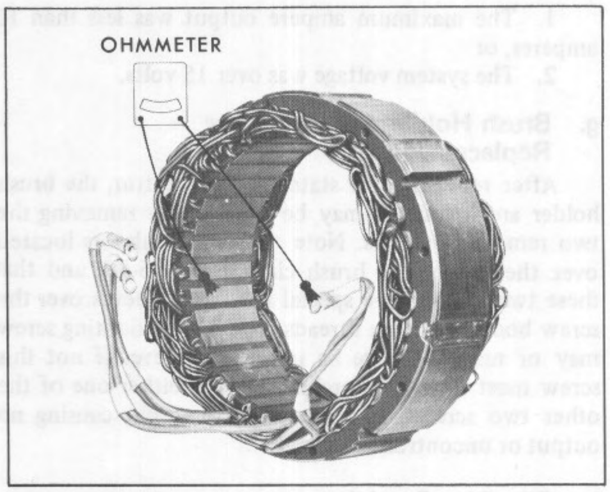


Fig. 6-62 Checking Stator (With Heavy Duty Generator)

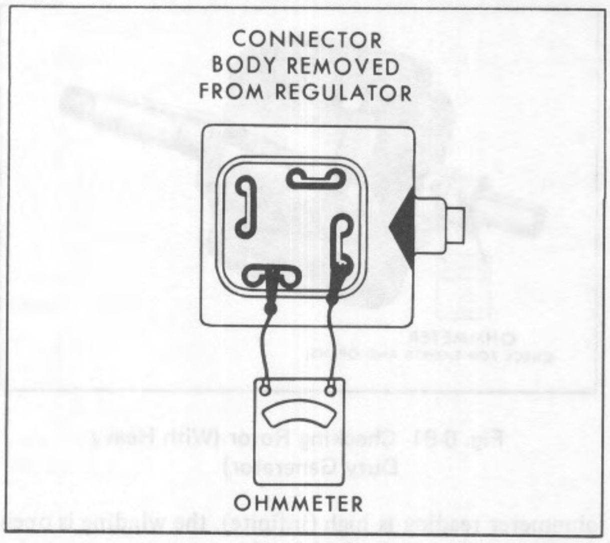


Fig. 6-63 Checking Connector Body (With Heavy Duty Generator)

the windings are grounded. The delta windings cannot be checked for opens or for short circuits without laboratory test equipment. However, if all other electrical checks are normal and the generator fails to supply rated output, but will supply at least 10 amperes output, shorted stator windings are indicated.

f. Regulator Check (Fig. 6-63)

Since the regulator is completely enclosed, there is no practical way to check this unit with a test instrument. If none of the previous checks show any defects, and an overcharged condition was present, remove the connector body from the regulator and check with an ohmmeter using the middle range scale. Connect the ohmmeter to each adjacent pair of terminals, making four checks in all. If any one check is infinite, replace the connector body. The connector body need not be checked for an undercharged condition.

If all of the previous checks are satisfactory, replace the regulator provided that in the previous performance checks:

1. The maximum ampere output was less than 10 amperes, or
2. The system voltage was over 15 volts.

g. Brush Holder and Regulator Replacement

After removing the stator and diode trio, the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Fig. 6-58, and that these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled output.

h. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated in order that the slip rings will be cleaned evenly.

Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

i. Bearing Replacement and Lubrication

The drive end frame bearing is sealed on both sides, and cannot be lubricated. To replace the bearing, pull off of rotor shaft using Puller J-8433. Use a tube or collar that just fits over the inner race to press the new bearing into the end frame.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to relubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing.

To install a new bearing, use the tube or collar to press the bearing in from the outside of the housing towards the inside to the dimension shown in Fig. 6-64. Fill the plug with No. 1948791 lubricant or equivalent so that when pressed in flush with the end frame the grease reservoir will be half filled. Insure that some of the lubricant will be contacting the bearing when the plug is assembled. Use a new seal, and press in to the dimension shown in Fig. 6-64. Coat the seal lip with the lubricant to facilitate assembly of the rotor shaft into the bearing. Note that the lip of the seal is toward the bearing.

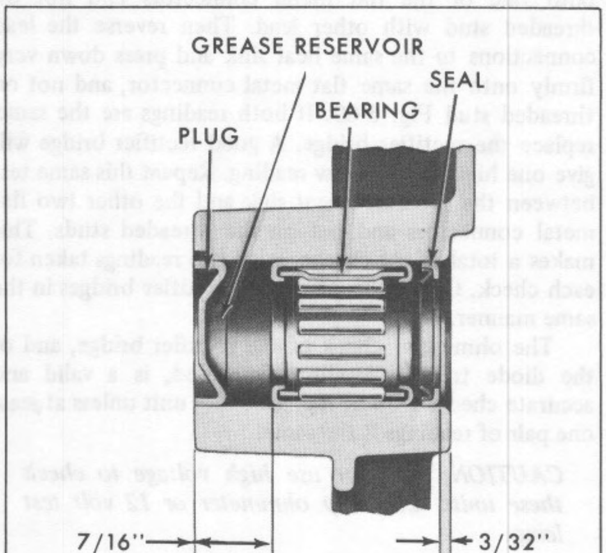


Fig. 6-64 Slip Ring End Bearing Assembly (With Heavy Duty Generator)

SPECIFICATIONS

BATTERY

All	R 91S
Capacity	74 AMP Hours
Full Charge Specific Gravity @ 80°F.	1.250 to 1.280
Voltage	12 Volts
Plates Per Cell	15
Cables	1/0 Gage
Terminal Grounded	Negative
Cranking Power at 0°F	3600 Watts

STARTER MOTOR

Brush Springs Tension	35 OZ
No Load Specifications	
Voltage	9 Volts
Amperage	65-95 AMPS
Speed	7,000-10,500 RPM

SOLENOID

Amperage Draw at 10 Volts	
Hold-In Winding	14.5-16.5 AMPS
Both Windings	41-47 AMPS

GENERATOR

Rated Output (At 14 Volts):	
W/O Air Conditioning	42 AMPS
With Air Conditioning	63 AMPS
Limousine and Commercial Chassis*	80 AMPS
Commercial Chassis with H.D. Generator	145 AMPS
Field Current Draw (At 12 Volts and 80°F)	4.0 to 4.5 AMPS
Pulley Ratio:	
All	3.214 to 1
Limousine and Commercial Chassis*	3.067 to 1
Commercial Chassis With H.D. Generator	2.275 to 1

DISTRIBUTOR	HEI	BREAKER
Initial Timing	10° BTDC	10° BTDC
Rotation	Clockwise	Clockwise
Dwell Angle		
Range	Variable	28° - 32°
Set to		30°
Capacitor	None	18 - 23 - MFD
Firing Order	1,5,6,3,4,2,7,8	
Centrifugal Advance		See Fig. 6-28
Vacuum Advance		See Fig. 6-28

IGNITION COIL	HEI	BREAKER
Primary Resistance	4-5 OHMS	1.77-2.01 OHMS
Secondary Resistance	8000-9500	3,000-20,000 OHMS
Wiring Harness Primary Resistance (@ 80°F)	None	1.3-1.35 OHMS

SPARK PLUGS

Type (AC Number)	R-45NS
Gap	.035 In.
Thread Diameter	14 MM
Torque	25 Foot-Pounds

*Also included with Trailer Towing Package.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Torque
260M	Battery Cable to Battery Screw	3/8–16	70 In. Lbs.
260M	Battery Hold Down Screw	5/16–24	6 Ft. Lbs.
260M	Battery Ground Strap to Frame Screw	Self Tapping	22 Ft. Lbs.
286M	Distributor Clamp Nut	5/16–24	18 Ft. Lbs.
260M	Generator Adjusting Link to Generator Screw	5/16–18	10 Ft. Lbs.
300	Generator Support Bracket Screw	3/8–16	17 Ft. Lbs.
280	Generator Support Bracket Nut	3/8–24	17 Ft. Lbs.
286M	Generator Terminal Nuts	1/4–20	26 In. Lbs.
—	Spark Plugs	14 mm	25 Ft. Lbs.
280M	Starter Motor Mounting Screw	7/16–14E 3/8–16C	46 Ft. Lbs.
Special	Starter Motor Brace to Mounting Screw	5/16–18	12 Ft. Lbs.
Special	Starter Motor Brace Mounting Nut	1/4–20	6 Ft. Lbs.

NOTE: Refer to back of manual, page 16-1 for bolt and nut markings and steel classification.

SPECIAL TOOLS

A B C

Fig. 6-65 Special Tools

Key	Tool No.	Name
A	J-23600	Belt Tension Gage
B	J-21008	Diode Tester
C	J-8433	Puller

THEORY OF OPERATION

The engine fuel system, Fig. 6-66, covered in this section includes fuel pump with integral filter, fuel line to carburetor, carburetor, intake manifold and related components of these assemblies.

Fuel Requirements

Cadillac engines are designed to operate on unleaded or low lead fuels of at least 91 Research Octane. These fuels will minimize spark plug fouling and emission control system deterioration. Fuels with Regular grade octane quality should be used *only* when needed to eliminate knock – a metallic rapping noise generated during the combustion process. The engine does not require Premium fuel.

On cars to be used in foreign countries, there is a possibility that the best available fuels are so low in anti-knock quality that it may be necessary to lower the octane requirement of the engine. If persistent knocking is encountered with the best fuel available, it may be necessary to retard spark timing. Engine fuel requirements are reduced by approximately one octane number (Motor Method) for each 2-1/2 degrees that spark timing is retarded from the normal 10 degree setting. Do not retard beyond top dead center.

Do not "power time" the engine, as variations in fuels, altitude and weather conditions will affect octane requirements. Never advance the spark beyond 10° B.T.D.C.

High Altitude Engine

The high altitude engine is modified for improved performance and emissions at altitudes above 4,000 feet using unleaded or low lead fuel. Short trips below 4,000 feet can be run on unleaded or low lead fuel, although some detonation may occur. Extended driving for several days below 4,000 feet will require premium fuel. Continuous operation below 4,000 feet will require that the engine be returned to the original calibration.

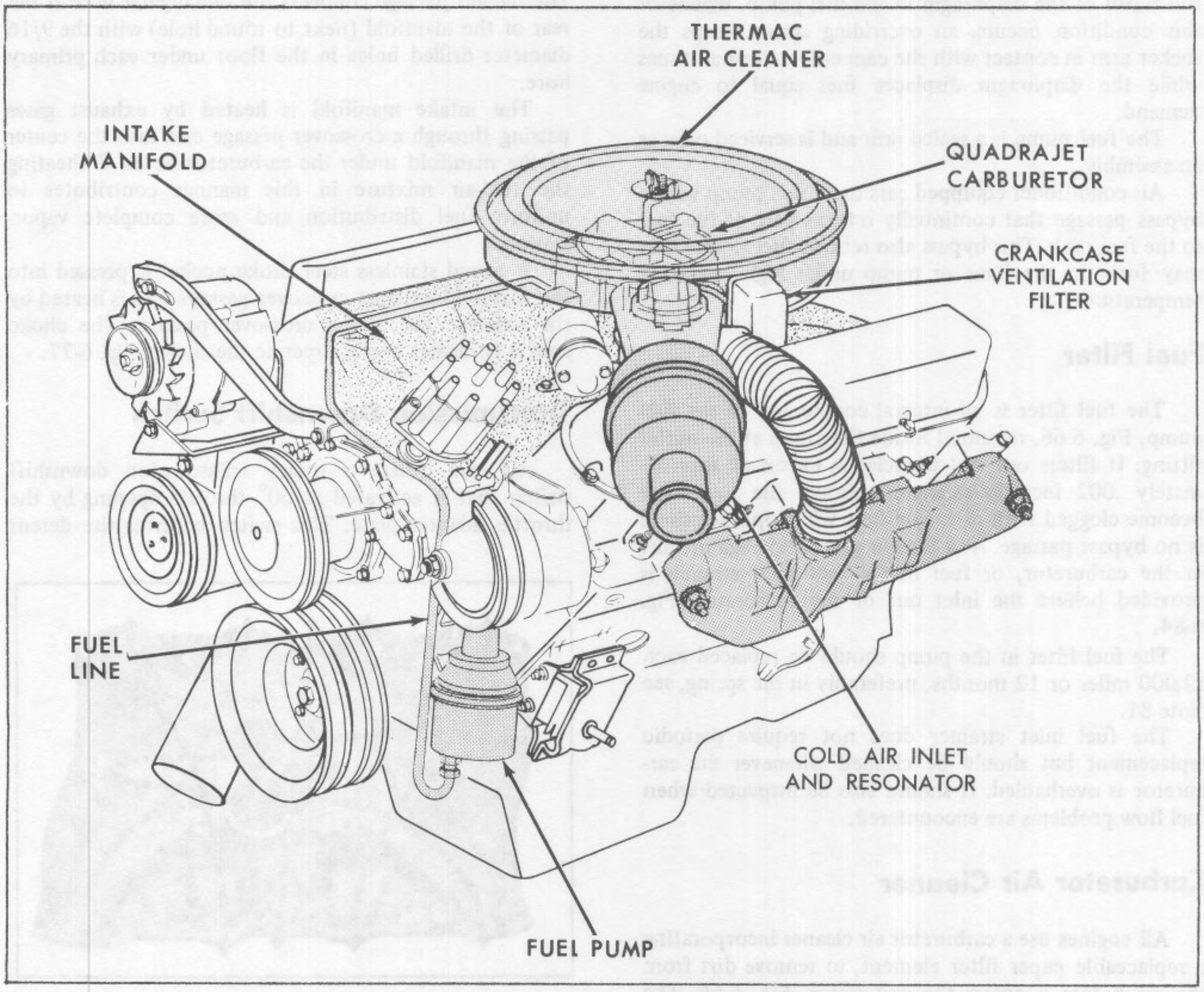


Fig. 6-66 Fuel System Components

Storage Precautions

When a car is to be put in storage for 30 days or longer, it is best to drain all gasoline from the fuel system, including carburetor, fuel filter, fuel pump, lines and tank. This assures freedom from gum deposits that would be formed by evaporation of the fuel. See Section 0, Page 0-9 for further precautions.

Fuel Pump

The fuel pump, Fig. 66, is mounted on the left front of the engine and incorporates a large fuel reservoir. The pump rocker arm is driven by an eccentric bolted to the camshaft. Fuel is drawn into the fuel pump on the upward stroke of the diaphragm as the rocker arm is moved downward by the cam eccentric working against the force of the spring. The diaphragm is forced downward by the spring during the delivery stroke of the pump, and exerts pressure on the fuel equal to the spring load as the eccentric travels to minimum stroke. This design provides a smooth, even flow of fuel to the carburetor.

Most engine operating conditions do not require a full travel of the diaphragm in the fuel pump. Whenever this condition occurs, an overriding spring keeps the rocker arm in contact with the cam eccentric at all times while the diaphragm displaces fuel equal to engine demand.

The fuel pump is a sealed unit and is serviced only as an assembly.

Air conditioner equipped cars use a fuel pump with a bypass passage that continually returns part of the fuel to the fuel tank. This bypass also returns fuel vapors that may form in the lines or pump under high operating temperatures.

Fuel Filter

The fuel filter is an integral component of the fuel pump, Fig. 6-66, mounted inside the pump at the outlet fitting. It filters out dirt particles in excess of approximately .002 inch in diameter. Should the fuel filter become clogged with dirt, fuel flow will stop since there is no bypass passage. As a further precaution against dirt in the carburetor, or fuel line a fuel inlet strainer is provided behind the inlet nut of the carburetor, Fig. 6-84.

The fuel filter in the pump should be replaced each 12,000 miles or 12 months, preferably in the spring, see Note 81.

The fuel inlet strainer does not require periodic replacement but should be cleaned whenever the carburetor is overhauled. It should also be inspected when fuel flow problems are encountered.

Carburetor Air Cleaner

All engines use a carburetor air cleaner incorporating a replaceable paper filter element, to remove dirt from the air before it enters the carburetor, Fig. 6-66. The addition of a cold air inlet duct and resonator reduces air cleaner noise and provides cooler air to the air cleaner, for increased engine performance at all altitudes.

CAUTION: Do not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the air cleaner is removed, backfiring can cause fire in the engine compartment.

Intake Manifold

The intake manifold is designed to provide passages that are short and nearly equal in length. Each pair of bores, one primary and one secondary, feeds fuel to four cylinders two on each bank as shown in Fig. 6-67.

The intake manifold has two additional passages for circulating exhaust gas to the induction system by way of an exhaust gas recirculating (EGR) valve mounted at the rear of the manifold. These passages and EGR valve are part of the oxides of nitrogen (NO_X) emission control system.

One passage connects the exhaust gas crossover passage with the round hole at the rear of the manifold. The second passage connects the rectangular hole at the rear of the manifold (next to round hole) with the 9/16 diameter drilled holes in the floor under each primary bore.

The intake manifold is heated by exhaust gases passing through a crossover passage cast into the center of the manifold under the carburetor bores. Preheating the fuel-air mixture in this manner contributes to uniform fuel distribution and more complete vaporization.

A round stainless steel choke pocket is pressed into the manifold exhaust crossover passage and is heated by the exhaust gas in the crossover passage. The choke pocket furnishes heat to operate the choke, Fig. 6-77.

Transmission Downshift Switch

All cars utilize a rotary transmission downshift switch that is activated at 60° throttle opening by the throttle adapter plate. This switch controls the detent

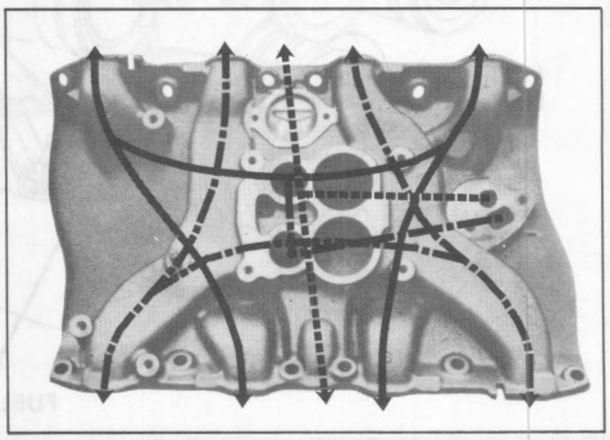


Fig. 6-67 Intake Manifold Passages

downshift of the transmission through an electrical circuit that energizes the transmission detent solenoid.

The switch is located at the left of the carburetor and secured by two screws to a support attached to the intake manifold. Adjustment of the switch is covered in Section 7, Note 4c.

GENERAL DESCRIPTION

CADILLAC QUADRAJET CARBURETOR

The four-barrel Quadrajet carburetor, Fig. 6-68, has two stages of operation. The primary (fuel inlet) side has small bores with a triple venturi equipped with plain tube nozzles. Its metering principles are similar to those of other carburetors using the venturi principle. The triple venturi stack up, plus the smaller primary bores, give an excellent fuel control in the idle and economy ranges of operation. Fuel metering in the primary side is accomplished with metering rods, operating in main metering jets, positioned by a power piston responsive to manifold vacuum. The secondary side has two very large bores to supplement air and fuel flow from the primary bores. The air valve principle is used in the secondary side for metering control, which means that fuel is metered in direct proportion to the air passing through the secondary bores.

The fuel reservoir (float bowl) is centrally located. The float system uses a single pontoon float. The float needle has a synthetic tip which gives added protection against flooding problems caused by dirt.

Idle mixture adjustment limiter caps are used on the idle mixture screws. The plastic limit caps permit idle mixture screws to be adjusted approximately 1/2 turn leaner without breaking the cap. At 24,000 miles, if C0 is high, the mixture may be adjusted within the limits of the caps. If idle C0 cannot be reduced to specifications, the stop tang must be cut off the limiter cap and

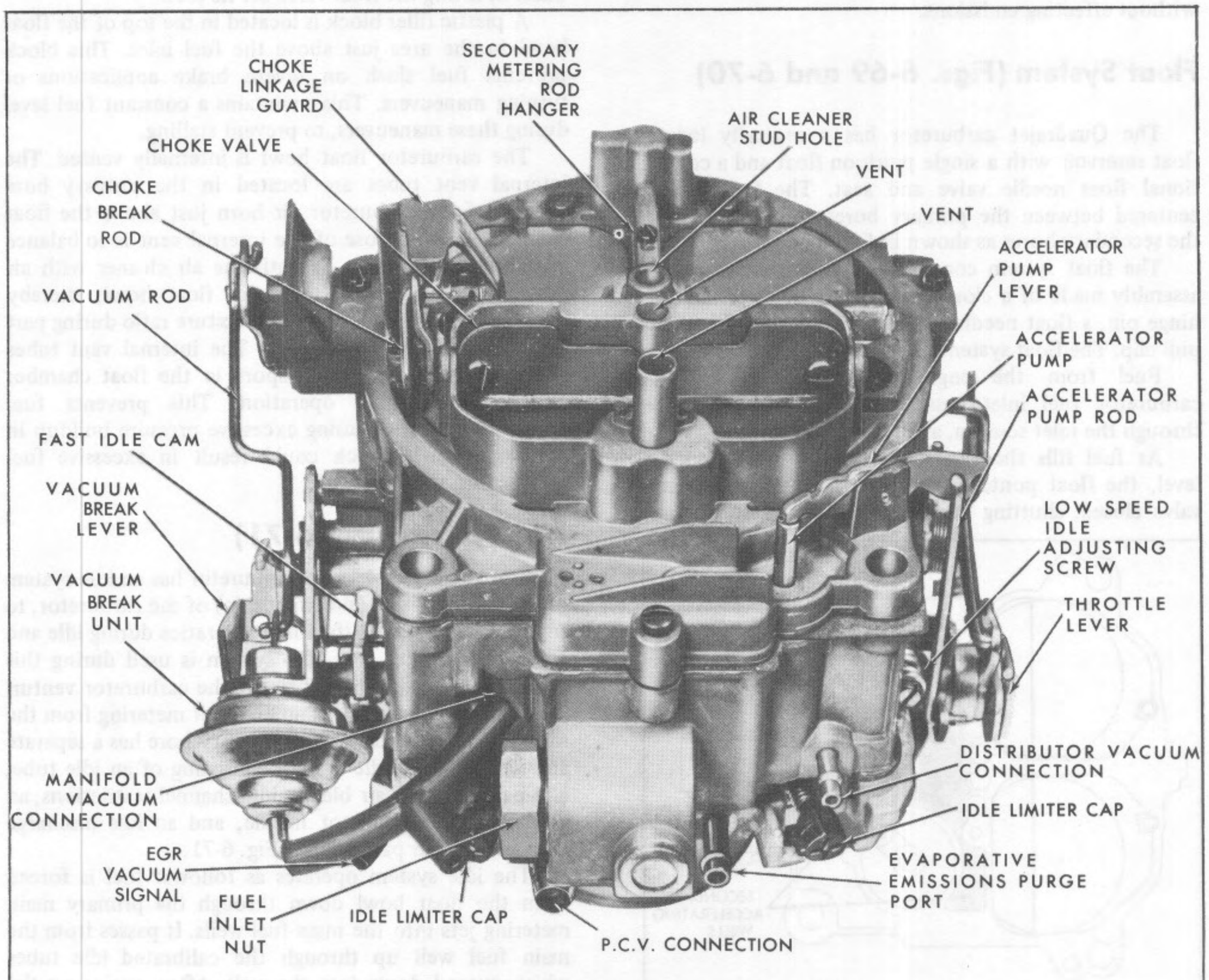


Fig. 6-68 Quadrajet 4MV Carburetor

mixture readjusted. Complete instructions for readjustment of the idle mixture is described in Note 66.

The fuel tank is not vented to atmosphere. All fuel vapors are collected in a vapor canister. Purge ports to remove the fuel vapors from the collection canister are provided in the carburetor throttle body. Purging is varied by a timed port positioned above the throttle valves and is controlled by the amount of primary throttle valve opening.

A timed vacuum signal for the Exhaust Gas Recirculation (E.G.R.) valve is taken from ports in the carburetor throttle body. Vertical and horizontal ports located above the right primary throttle valve provide the vacuum signal for positioning of the E.G.R. Valve dependent upon the amount of primary throttle valve opening. Carburetors used on California vehicles (except commercial vehicles) have only the horizontal port.

The choke coil assembly is changed in that a vacuum operated diaphragm plunger mounted on the remote choke coil assembly is used for improved warm engine starting. The assembly is called a vacuum re-indexing unit. Its purpose is to apply additional pressure on the choke coil which, in turn, increases the pressure holding the choke valve closed for improved engine starting without effecting emissions.

Float System (Figs. 6-69 and 6-70)

The Quadrajet carburetor has a centrally located float reservoir with a single pontoon float and a conventional float needle valve and seat. The fuel bowl is centered between the primary bores and is adjacent to the secondary bores as shown in Fig. 6-69.

The float system consists of a float bowl, pontoon assembly made of a closed cellular plastic material, float hinge pin, a float needle valve and seat, and a float valve pull clip. The float system operates as follows:

Fuel from the engine fuel pump enters the carburetor fuel inlet passage in Fig. 6-70. It passes through the inlet screeen, and needle seat.

As fuel fills the float bowl to the prescribed fuel level, the float pontoon rises and forces the fuel inlet valve closed, shutting off all fuel flow. As fuel is used

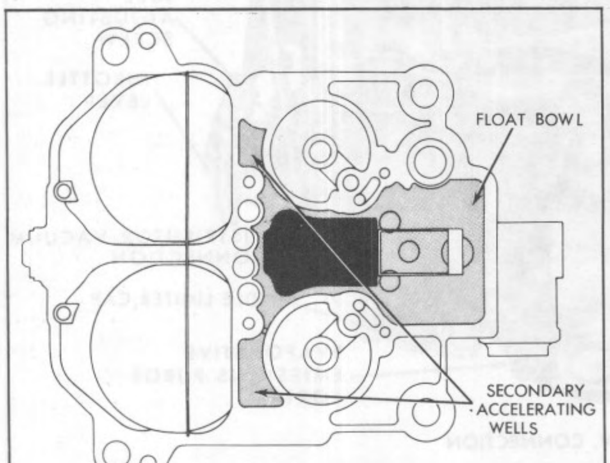


Fig. 6-69 Fuel Reservoir

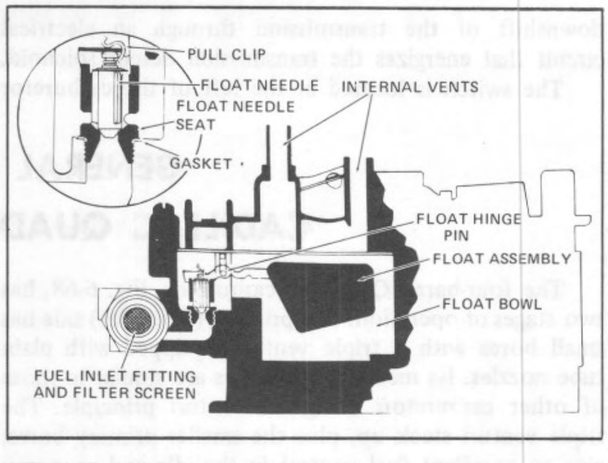


Fig. 6-70 Float System

from the float bowl, the float drops and allows more fuel to enter the float bowl until the correct fuel level is reached. This cycle continues, constantly maintaining a positive fuel level in the float bowl.

A float needle pull clip, fastened to the float valve, hooks over the center of the float arm. Its purpose is to assist in lifting the float valve off its seat.

A plastic filler block is located in the top of the float bowl in the area just above the fuel inlet. This block prevents fuel slosh on severe brake applications or turning maneuvers. This maintains a constant fuel level during these maneuvers, to prevent stalling.

The carburetor float bowl is internally vented. The internal vent tubes are located in the primary bore section of the carburetor air horn just above the float chamber. The purpose of the internal vent is to balance incoming air pressure beneath the air cleaner with air pressure acting on fuel in the float bowl, thereby maintaining a balanced air/fuel mixture ratio during part throttle and power operation. The internal vent tubes allow the escape of fuel vapors in the float chamber during hot engine operation. This prevents fuel vaporization from causing excessive pressure buildup in the float bowl, which could result in excessive fuel spillage into the manifold.

Idle System (Fig. 6-71)

The Quadrajet 4 barrel carburetor has an idle system on the primary side (fuel inlet side) of the carburetor, to supply the correct air/fuel mixture ratios during idle and off idle operation. The idle system is used during this period because air flow through the carburetor venturi is not great enough to obtain efficient metering from the main discharge nozzles. Each primary bore has a separate and independent idle system consisting of an idle tube, idle passages, idle air bleeds, idle channel restrictions, an idle mixture adjustment needle, and an idle discharge hole and idle air passage. See Fig. 6-71.

The idle system operates as follows: fuel is forced from the float bowl down through the primary main metering jets into the main fuel wells. It passes from the main fuel well up through the calibrated idle tubes which extend down into the well. After passing up the idle tube, the fuel is mixed with air at the top of each tube through an idle air bleed. The fuel mixture then

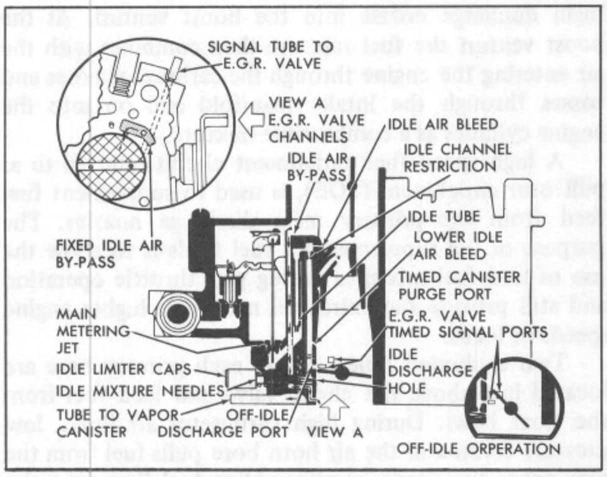


Fig. 6-71 Idle System

crosses over to the idle down channels where it passes through a calibrated idle channel restriction.

It then passes down the idle channel past the lower idle air bleed holes and off idle discharge ports, just above the throttle valves, where it is mixed with more air. The air/fuel mixture then moves down to the idle needle discharge holes where it enters the carburetor bores and mixes with air passing the slightly open throttle valves.

The venturi system is very sensitive to air flow and on applications where large amounts of idle air are needed to maintain higher idle speeds, the fixed idle air by-pass system is used. This consists of air channels which lead from the top of each carburetor bore in the air horn to a point below each primary throttle valve. At normal idle, extra air passes through these channels supplementing the air passing by the slightly opened throttle valves. The purpose of the idle air by-pass system is to allow reduction in the amount of air going past the throttle valves so that they can be nearly closed at idle. This reduces the amount of air flowing through the carburetor venturi to prevent the main fuel nozzles from feeding during idle operation.

The fuel tank is not vented to atmosphere and all fuel vapors are collected in a vapor collection canister from the fuel tank vent. In order to remove the fuel collected in the vapor canister, it is necessary to provide a means of purging the canister and burning the vapors in the engine.

Purge ports for the vapor collection canister are provided in the carburetor throttle body. The ports are located slightly above the throttle valves during the idle position of the valve. As the throttle valves are opened to the off idle position, the purge ports are in the low pressure area and begin to remove fuel vapors from the vapor canister. The purge ports are relatively large and provide adequate purge to remove all vapors collected in the canister. They will bleed constantly in varying amounts during off idle, part throttle, and wide open throttle operation of the engine.

An Exhaust Gas Recirculation (E.G.R.) system is used on all models to reduce oxides of nitrogen emissions. The E.G.R. valve is operated by a vacuum supply signal taken from the carburetor. Two punched ports - one horizontal and one vertical (one horizontal punched port in California vehicle carburetors, except commercial vehicles) - located in one primary bore (see inset, Figure 6-71) supply a timed vacuum signal for E.G.R. valve operation in the off-idle and part throttle ranges of the carburetor.

As the primary throttle valve is opened beyond the idle position, the horizontal port is exposed to manifold vacuum (low pressure) to supply a vacuum signal to the E.G.R. valve. By contrast, the vertical port is positioned in the primary bore such that the port at lower air flows is exposed to higher air pressure in the venturi and the port adds air to the E.G.R. passage in the throttle body to modulate the amount of vacuum signal supplied by the horizontal port. Thus, E.G.R. valve operation is "timed" for precise metering of exhaust gases to the intake manifold dependent upon location of the ports in the carburetor bore and by the degree of throttle valve opening.

As the primary throttle valve is opened further in the part throttle range, at higher air flows the vacuum signal decreases at the horizontal port. The vertical port ceases to function as an air bleed and is gradually exposed to manifold vacuum to supplement the vacuum signal at the horizontal port to maintain correct E.G.R. valve position.

The horizontal and vertical ports connect to a cavity in the throttle body which, in turn, through a passage supplies the vacuum signal to an E.G.R. tube pressed into the front corner of the throttle body.

The purpose of the Exhaust Gas Recirculation (E.G.R.) system is to reciruclate a small portion of the exhaust gases into the intake manifold to cause lower combustion temperatures to reduce oxides of nitrogen emissions during the off-idle and part throttle ranges of engine operation.

The E.G.R. valve remains closed during periods of engine idle and deceleration operation and in cold weather during warmup only.

Off Idle Operation

As the primary throttle valves are opened from curb idle to increase engine speed, additional fuel is needed to combine with the extra air entering the engine. This is accomplished by the slotted off-idle discharge ports. As the primary throttle valves open, they pass by the off-idle ports, gradually exposing them to high engine vacuum below the throttle valves. The additional fuel added from the off-idle ports mixes with the increasing air flow past the opening throttle valves to meet increased engine air and fuel demands.

Further opening of the throttle valves increases the air velocity through the carburetor venturi sufficiently to cause low pressure at the lower idle air bleeds. As a result, fuel begins to discharge from the lower idle air bleed holes (located at the bottom of the large venturi skirt) and continues to do so throughout operation of the part throttle to wide open throttle ranges, supplementing the main discharge nozzle delivery.

The idle mixture needle holes and off-idle discharge ports continue to supply sufficient fuel for engine requirements until air velocity is high enough in the

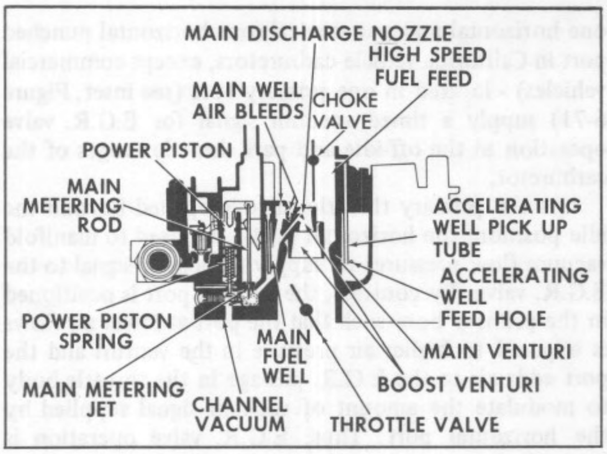


Fig. 6-72 Main Metering System

venturi area to obtain efficient fuel flow from the main metering system.

Main Metering System (Fig. 6-72)

The main metering system supplies fuel to the engine from off-idle to wide open throttle operation. The Quadrajet carburetor has two bores that feed fuel and air during this range. The two primary bores of the carburetor meter fuel through the venturi principle. This design allows the use of multiple venturi for finer, more stable and accurate metering control during light engine loads.

The main metering system is in operation at all times when air flow through the venturi is high enough to maintain efficient fuel flow from the main fuel discharge nozzles. It begins to feed fuel when the idle system can no longer meet the engine requirements.

The main metering system consists of main metering jets; vacuum operated metering rods; main fuel well; main well air bleeds; fuel discharge nozzles; and triple venturi. The system operates as follows:

During cruising speeds and light engine loads, engine manifold vacuum is high. Manifold vacuum holds the power piston and main metering rods down in contact with the adjustable part throttle screw and in the main metering jets. Manifold vacuum is supplied through a channel to the vacuum operated power piston connected to the primary main metering rods. Fuel flow from the float bowl is metered between the metering rods and the main metering jets.

As the primary throttle valves are opened beyond the off-idle range, allowing more air to enter the engine manifold, air velocity increases in the carburetor venturi. This causes a drop in pressure in the large venturi which is increased many times in the double boost venturi. Since the low pressure (vacuum) is now in the smallest boost venturi, fuel flows from the main discharge nozzles as follows:

Fuel flows from the float bowl through the main metering jets into the main fuel well and is bled with air from the vent at the top of the main well and side bleeds. The fuel in the main well is mixed with air from the main well air bleeds and then passes through the main discharge nozzle into the boost venturi. At the boost venturi the fuel mixture then combines with the air entering the engine through the carburetor bores and passes through the intake manifold and on into the engine cylinder as a combustible mixture.

A high speed fuel enrichment circuit referred to as pull over enrichment (POE), is used to supplement fuel feed from the primary main discharge nozzles. The purpose of the supplementary fuel feeds is to allow the use of lean fuel mixtures during part throttle operation and still provide the extra fuel needed at higher engine speeds or loads.

Two calibrated holes, one in each primary bore are located just above the choke valve and feed fuel from the float bowl. During high carburetor air flows, low pressure created in the air horn bore pulls fuel from the high speed fuel feeds, supplementing fuel flow from the primary main metering system. The pull over enrichment system begins to feed fuel at approximately 8 pounds of air per minute, and continues to feed at higher engine speeds or loads to provide extra fuel necessary for good engine performance.

This feature is not used in the commercial vehicle carburetors.

Power System (Fig. 6-73)

The power system in the Quadrajet carburetor provides mixture enrichment for power requirements under acceleration high loads or high speed operation. The richer mixture is supplied through the main metering system in the primary side of the carburetor.

The power system located in the primary side consists of a vacuum piston and spring located in a cylinder connected by a passage to intake manifold vacuum. The spring located beneath the vacuum operated power piston tends to push the piston upward against manifold vacuum.

An "adjustable part throttle" feature has been designed to allow each carburetor to be individually calibrated at time of assembly. Each carburetor is adjusted by the manufacturer to provide the most ideal air-fuel ratio for low exhaust emissions. The adjustable part throttle screw is used to raise or lower the power

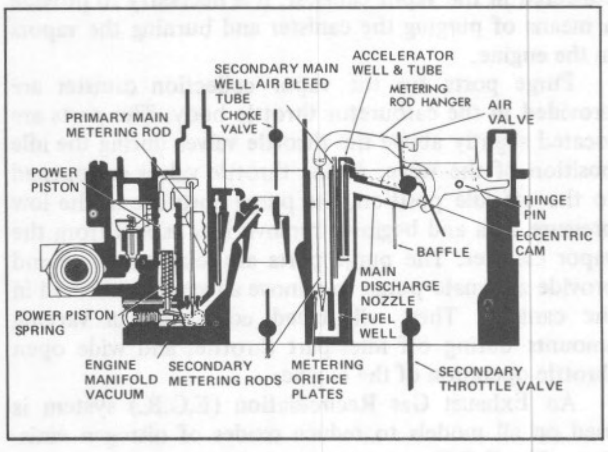


Fig. 6-73 Power System

piston and metering rods to provide this ratio. Upon completion of this adjustment the access hole is sealed and no further adjustment should be attempted. This adjustment should not be attempted in the field.

On part throttle and cruising ranges, manifold vacuum is sufficient to hold the power piston down against spring tension so that the larger diameter of the metering rod tip is held in the main metering jet orifice. Mixture enrichment is not necessary at this point. However, as engine load is increased to a point where mixture enrichment is required, the spring tension overcomes the vacuum pull on the power piston and the tapered primary metering rod tip moves upward in the main metering jet orifice. This smaller diameter of the metering rod tip allows more fuel to pass through the main metering jet and enrich the mixture flowing into the primary main wells and out the main discharge nozzles.

When manifold vacuum rises and mixture enrichment is no longer needed, the vacuum overcomes the power piston spring tension and returns the larger portion of the metering rod into the metering jet orifice and back to normal economy ranges. However, as the engine speed and load increases further, the primary side of the carburetor can no longer meet the engine air and fuel requirements. To meet these demands, the secondary side of the carburetor is used. The secondary side contains throttle valves, spring loaded air valves, metering orifice plates, secondary metering rods, main fuel wells with air bleed tubes, fuel discharge nozzles, and accelerating wells and tubes. The secondary side operates as follows:

When the engine reaches a point where the primary bores cannot meet engine air and fuel demands, the primary throttle lever, working through connecting linkage to the secondary throttle shaft lever, begins to open the secondary throttle valves. As air flows through the secondary bores creating a low pressure (vacuum) beneath the air valve, atmospheric pressure on top of the air valve forces the air valve open against spring tension. This allows the required air for increased engine speed to flow past the air valve.

When the air valve begins to open, the upper edge of the air valve passes the accelerating well discharge port. As the valve passes the port it exposes the port to manifold vacuum. The port will immediately start to feed fuel from the accelerating wells.

The accelerating ports prevent a momentary leanness as the valve opens and the secondary nozzles have not begun to feed fuel. Discharge from the ports stops after the edge of the valve has passed the port.

The secondary main discharge nozzles (one for each secondary bore) are located just below the air valve and above the secondary throttle valves. Being in an area of low pressure, they begin to feed fuel as follows:

When the air valve begins to open, it rotates a plastic cam attached to the center of the main air valve shaft. The cam pushes upward on a lever attached to the secondary metering rods, raising the metering rods out of the secondary orifice plates. Fuel flows from the float chamber through the secondary orifice plates into secondary main wells, where it is mixed with air from the main well tubes at the bottom of the main wells. The air-blended-fuel mixture travels from the main wells to the secondary discharge nozzles and into the secondary bores. Here fuel mixture is mixed with air traveling through the secondary bores to supplement the air/fuel mixture delivered from the primary bores, and then goes on into the engine manifold and on to the engine cylinders as a combustible mixture.

As the throttle valves are opened further, and engine speeds increase, increased air flow through the secondary side of the carburetor opens the air valve to a greater degree, which in turn lifts the secondary metering rods further out of the orifice plates. The metering rods are tapered so that fuel flow through the secondary metering orifice plates is directly proportional to air flow through the secondary carburetor bores. In this manner correct air/fuel mixtures to the engine through the secondary bores can be maintained by the depth of the metering rods in the orifice plates.

There are three other features incorporated in the secondary metering system which are as follows:

1. The main well bleed tubes extend below the fuel level in the main well. These bleed air into the fuel in the well to blend the fuel with air quickly for good atomization as it leaves the secondary discharge nozzles.

2. A baffle plate is used in the secondary bore. Its purpose is to provide good fuel distribution by preventing too much fuel from going to the front of the engine.

3. Notched secondary air valves are used. The notched valve feature reduces the vacuum signal at the secondary nozzles and permits air to by-pass the air valve for leaner air/fuel mixture ratios during initial air valve opening. The leaner mixture improves throttle response when operating the vehicle at higher altitudes and in hot weather.

Air Valve Dashpot Operation (Fig. 6-74)

The secondary air valve is connected to a dashpot (called the vacuum break unit) by a rod, to control the opening rate of the air valve and prevent any secondary discharge nozzle lag.

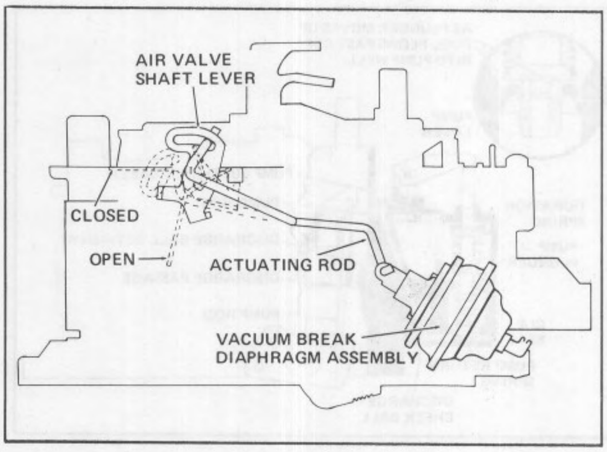


Fig. 6-74 Air Valve Dashpot Operation

Whenever manifold vacuum is above approximately 5" - 6" Hg, the vacuum break diaphragm system is seated. However, when the secondary valves are opened and manifold vacuum drops below the 5" - 6" point, the spring in the vacuum break unit will force the diaphragm and stem off its seat. The rate of movement of the seat is controlled by a restriction in the cover of the vacuum break unit.

When the diaphragm is seated, it pulls the rod to the front end of the slot in the air valve shaft lever. As the air valve starts to open, when the secondary throttle valves are opened, the restriction in the tube will restrict the air movement to the back side of the diaphragm and slow down the opening of the air valve.

Accelerating Pump System (Fig. 6-75)

During quick acceleration, when the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously. The fuel, which is heavier, tends to lag behind causing a momentary leanness. The accelerator pump is used to provide the extra fuel necessary for smooth operation during this time.

The accelerating pump system is located in the primary side of the carburetor. It consists of a spring loaded pump plunger and pump return spring, operating in a fuel well. The pump plunger is operated by a pump lever on the air horn which is connected directly to the throttle lever by a pump rod. The pump rod is located in the inner hole of the pump lever on all cars except the commercial chassis and altitude options which is located in the outer hole.

When the pump plunger moves upward in the pump well, as happens during throttle closing, fuel from the float bowl enters the pump well through a slot in the top of the pump well. It flows past the synthetic pump cup seal into the bottom of the pump well. The pump cup is a floating type which moves up and down on the pump plunger head. When the pump plunger is moved upward, the flat on top of the cup unseats from the flat on the plunger head and allows free movement of fuel through the inside of the cup into the bottom of the pump well. This also vents any vapors which may be in the bottom of the pump well so that a solid charge of fuel can be maintained in the fuel well beneath the plunger head.

When the primary throttle valves are opened, connecting linkage forces the pump plunger downward. The pump cup seats instantly and fuel is forced through the pump discharge passage, where it unseats the pump discharge check ball and passes on through the passage to the pump jets located in the air horn where it sprays into the venturi area of each primary bore.

It should be noted the pump plunger is spring loaded. The upper duration spring is balanced with the bottom pump return spring so that a smooth sustained charge of fuel is delivered during acceleration.

The pump discharge check ball seats in the pump discharge passage during upward motion of the pump plunger so that air will not be drawn into the passage; otherwise, a momentary acceleration lag could result.

During high speed operation, a vacuum exists at the pump discharge jets. A cavity just beyond the pump jets is vented to the top of the air horn, outside the carburetor bores. This acts as a suction break so that when the pump is not in operation fuel will not be pulled out of the pump jets into the venturi area. This insures a full pump stream when needed and prevents any fuel "pull over" from the pump discharge passage.

Choke System (Fig. 6-77)

A vacuum re-indexing choke assembly Fig. 6-76, is used on all cars to improve cold starts at high ambient temperature and to improve stall after start resistance.

The re-indexing choke is similar to the remote type choke except that a vacuum diaphragm with plunger is mounted on the choke assembly and is incorporated in the indexing of the assembly. When the engine is off, the index temperature is approximately 115°F. As soon as the engine starts and manifold vacuum is available, it is applied to the vacuum diaphragm which rotates the bi-metal coil mounting shaft to re-index the coil to 85°F., and remains at that indexing point during engine warm up and as long as vacuum is applied to the diaphragm.

The Quadrajet choke valve is located in the primary side of the carburetor. It provides the correct air/fuel mixture enrichment to the engine for quick cold engine starting and during the warm-up period. The air valve is locked partially closed until the engine is thoroughly

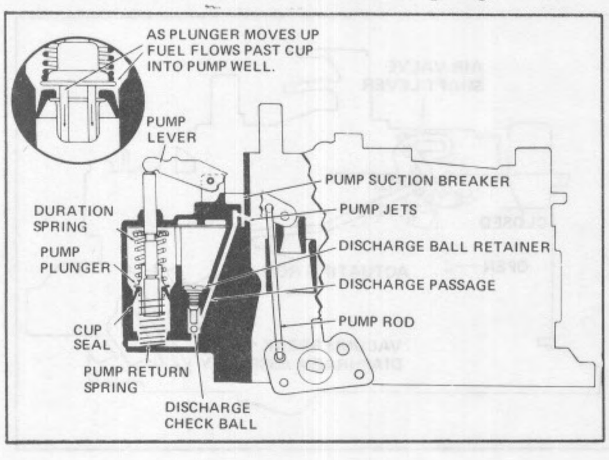


Fig. 6-75 Accelerator Pump System

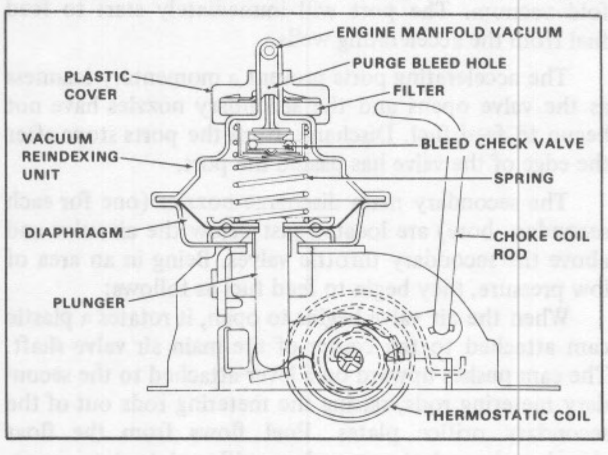


Fig. 6-76 Choke Coil—Vacuum Re-Indexing Unit

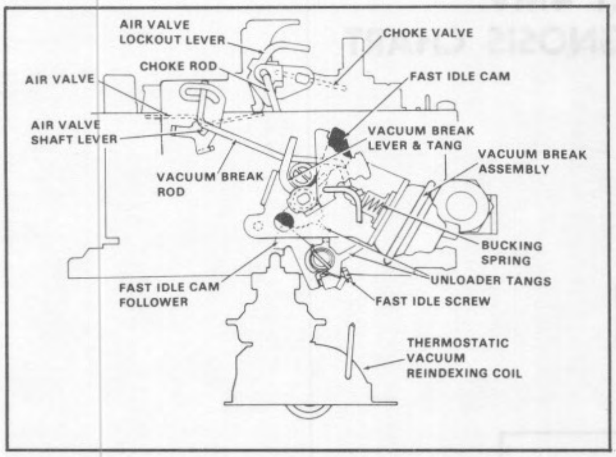


Fig. 6-77 Choke System

warm and choke valve is wide open. The air valve can open a maximum of 10° during warm-up to permit increased performance.

The choke system consists of a choke valve located in the primary air horn bore, a vacuum break unit, fast idle cam, connecting linkage, air valve lockout lever and a re-indexing choke assembly with thermostatic coil. The thermostatic coil is connected to the intermediate choke shaft and lever assembly. Choke operation is controlled by the combination of intake manifold vacuum, the off-set choke valve, temperature, and throttle position.

The thermostatic coil (part of the choke assembly) located on the engine manifold is calibrated to hold the choke valve closed when the engine is cold.

(NOTE: To close the choke valve, the primary throttle valves have to be opened to allow the fast idle cam follower to by-pass the steps on the fast idle cam and come to rest on the highest step of the cam.)

When the choke valve is closed, the air valve lock-out lever is weighed so that a tang on the lever catches the upper edge of the air valve permitting only 6°-10° of air valve opening.

During engine cranking, the choke valve is held closed by the tension of the thermostatic coil. This restricts air flow through the carburetor to provide a richer starting mixture. When the engine starts and is running, manifold vacuum applied to the vacuum break unit mounted on the float bowl will open the choke valve to a point where the engine will run without loading or stalling.

Included in the vacuum break unit is a spring loaded plunger. The purpose of the spring is to off-set choke thermostatic coil tension to provide leaner mixtures during warm up for reduced exhaust emissions. In colder temperatures, tension created by the thermostatic coil will overcome the tension of the plunger spring and provide less choke valve opening with a resultant slightly richer mixture. In warmer temperatures the thermostatic coil will have less tension and, consequently, will not compress the spring as much, thereby, giving a greater choke valve opening for slightly leaner mixtures.

This gives the engine sufficient fast idle and correct fuel mixture for running until the engine begins to warm up and heat the thermostatic coil. As the thermostatic coil on the engine manifold becomes heated, it relaxes its tension and allows the choke valve to open further because of intake air pushing on the off-set choke valve and the counterweight effect of the linkage and choke lever. Choke valve opening continues until the thermostatic coil is completely relaxed, at which point the choke valve is wide open.

When the engine is thoroughly warm, the choke coil allows the vacuum break lever to come down. When the choke shaft lever moves toward the up position, the end of the choke rod strikes a tang of the air valve lock-out lever. As the rod moves to the end of its travel, it pushes the lock-out tang upward, unlocking the air valve.

The choke system is equipped with an unloader mechanism which is designed to open the choke valve partially if the engine should become loaded or flooded. To unload the engine, the accelerator pedal must be depressed to the floor so that the throttle valves are held wide open. A tang on a lever on the choke side of the primary throttle shaft contacts the fast idle cam and, working through the intermediate choke shaft, forces the choke valve slightly open. This allows extra air to enter the carburetor bores, pass into the engine manifold and cylinders to lean out the fuel into a combustible mixture so that the engine will start.

Check choke mechanism for free operation. Any binding caused by petroleum gum formation on the choke shaft or from damage should be corrected.

53. Fuel Pump Tests

1. To check fuel pump capacity, raise car and disconnect fuel inlet hose at the pump and plug. On cars with A/C clamp off vapor return line; do not remove from pump (Use towel to absorb slight gas drainage.)

2. Connect about 2 feet of flexible gasoline hose (3/8 I.D.) to the fuel pump inlet nipple.

3. Lower car and insert end of flexible hose into gallon container with 1/2 gallon of kerosene, wash gas or similar solvent (not gasoline). Rest container on floor below the fuel pump. Be sure end of hose does not rest against bottom of container.

4. Disconnect fuel line at carburetor and slip about two feet of flexible gasoline hose (3/8 I.D.) over the flared end of the pipe.

5. Connect a jumper wire from the negative coil primary terminal to a good ground or disconnect HEI so that the engine will not start when cranked.

6. Crank engine to prime pump until approximately 1/2 pint of liquid has been pumped and all gasoline purged from the pump before checking output.

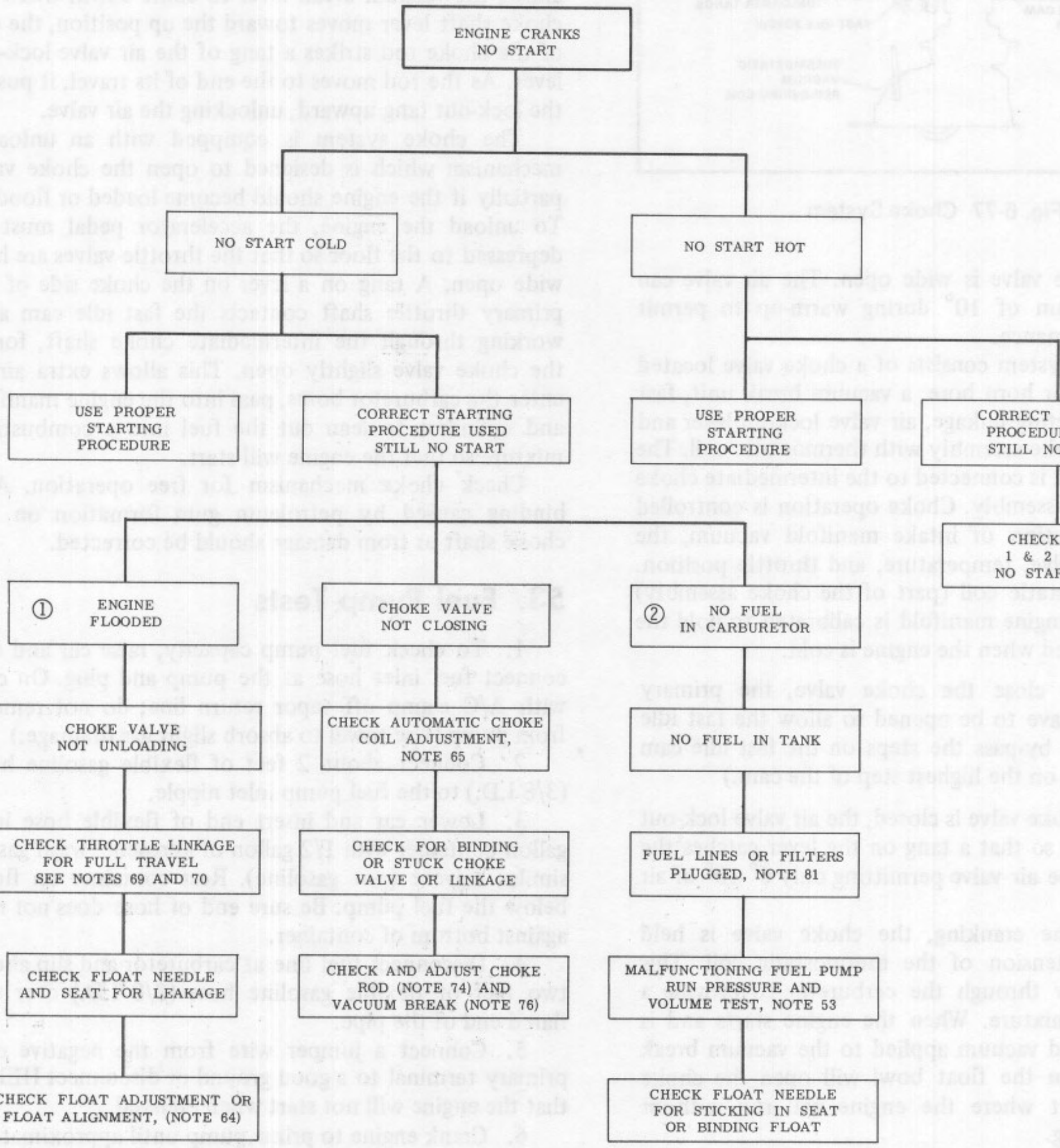
7. Seventeen strokes should fill a pint container. If liquid is delivered as specified, pump delivery is normal. If pump delivery is below normal, check for the following possible conditions:

a. Liquid leaking out of pump at fittings or joints. This should be obvious if gasoline has leaked, by the absence of paint on the pump or a clean spot on the engine or frame.

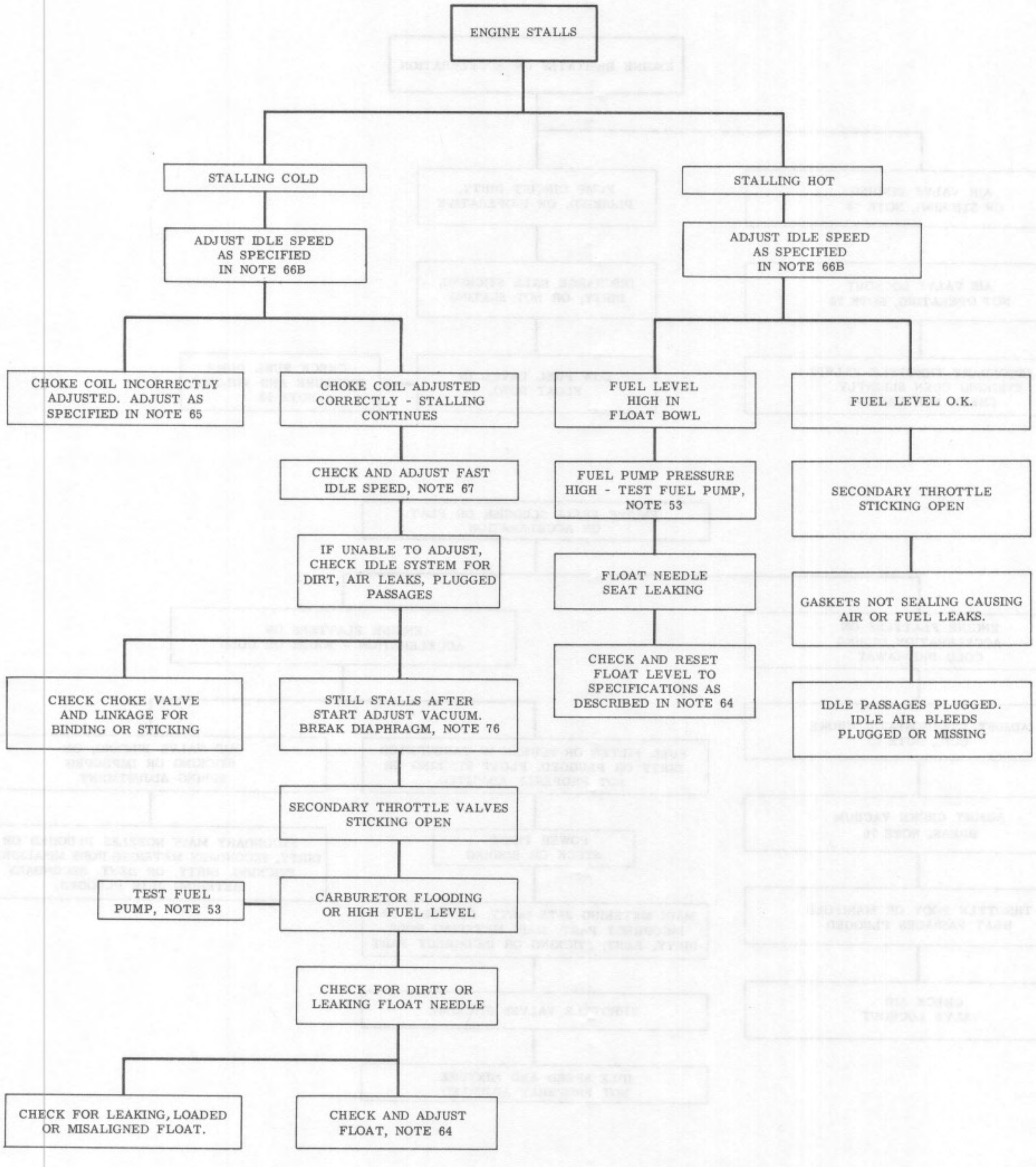
b. Plugged filter in pump. Replace and recheck.

c. Worn eccentric or arm. Remove pump as described in Note 82a and visually check fuel pump

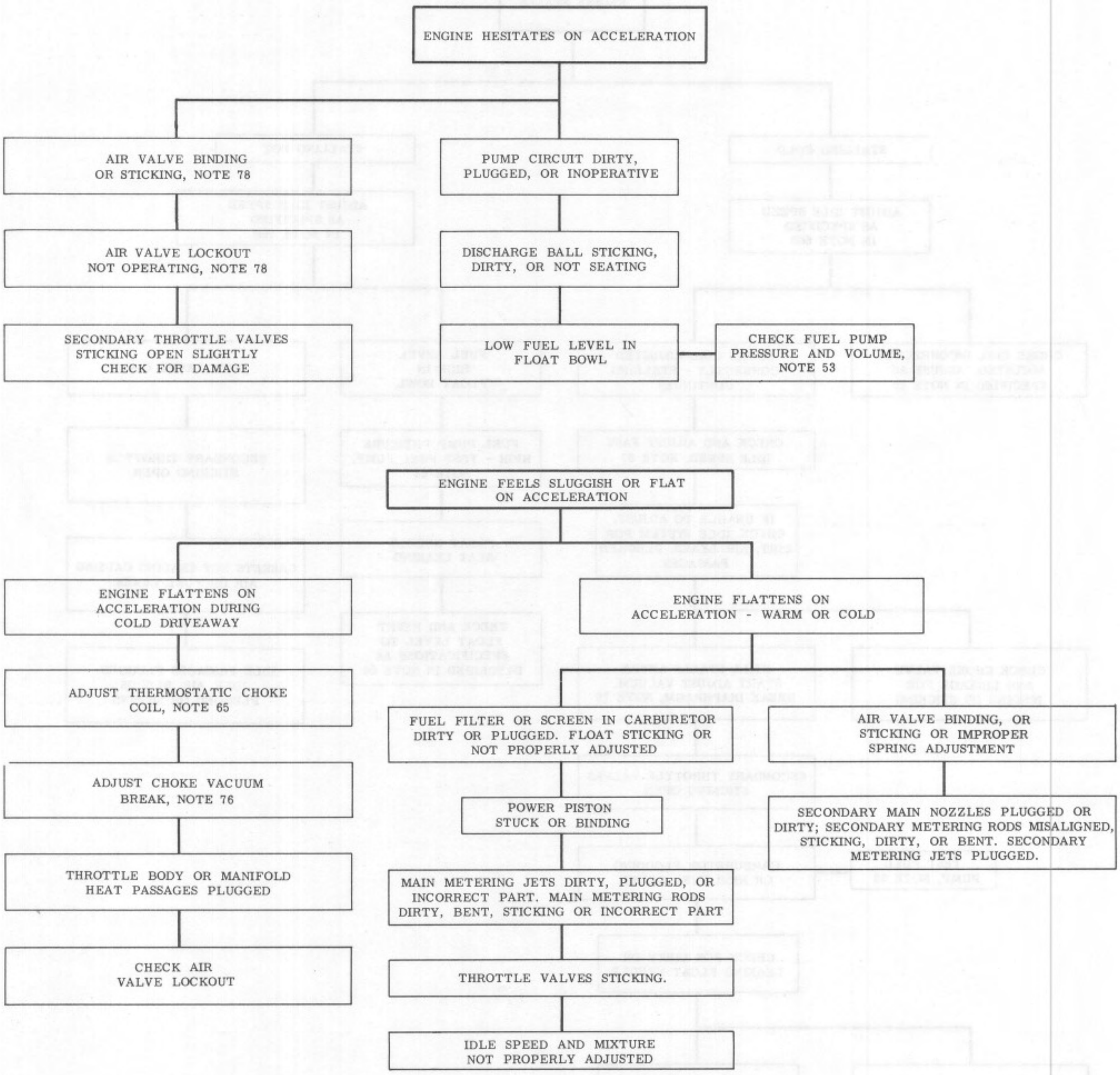
QUADRAJET 4MV CARBURETOR DIAGNOSIS CHART



QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



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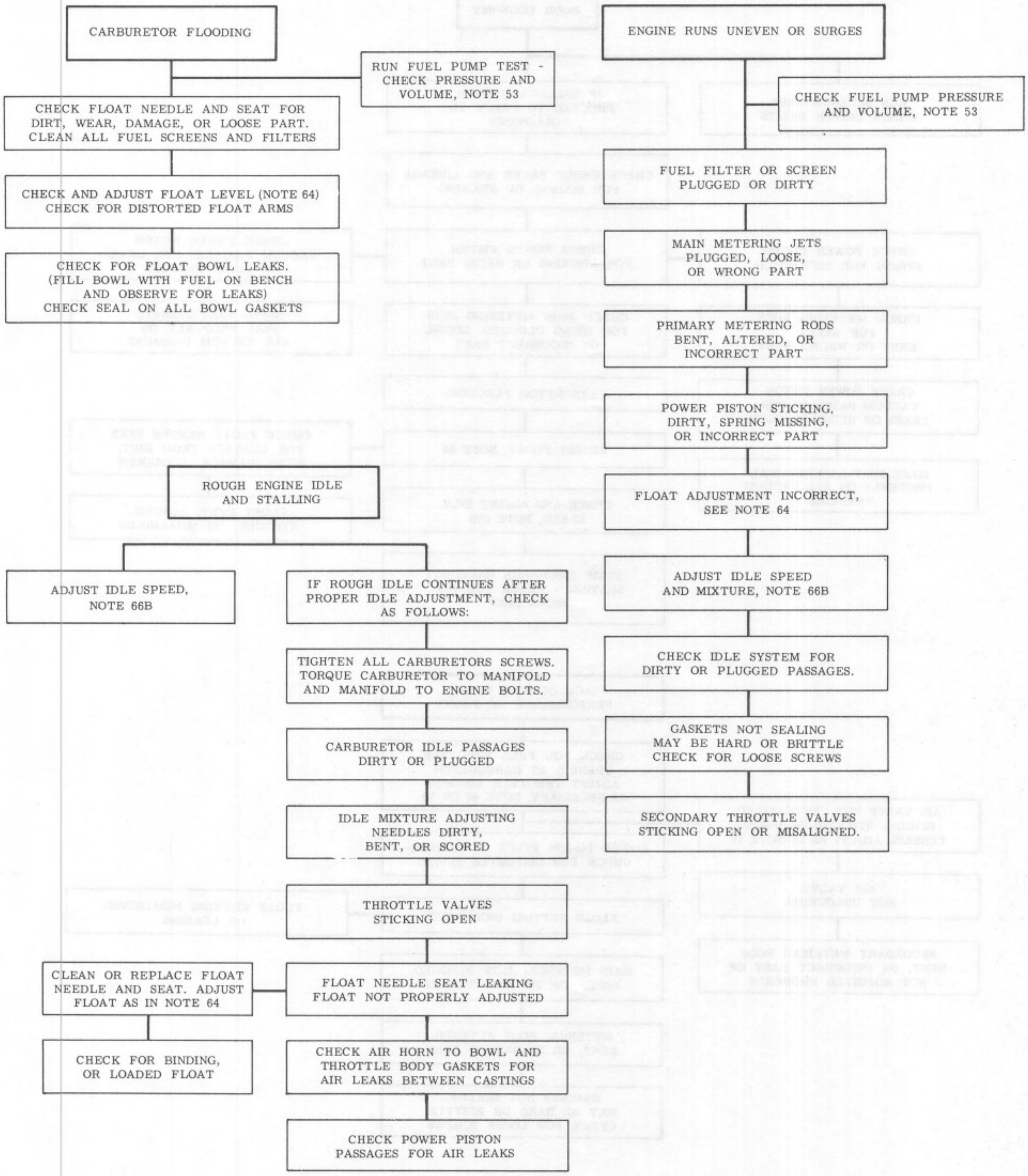

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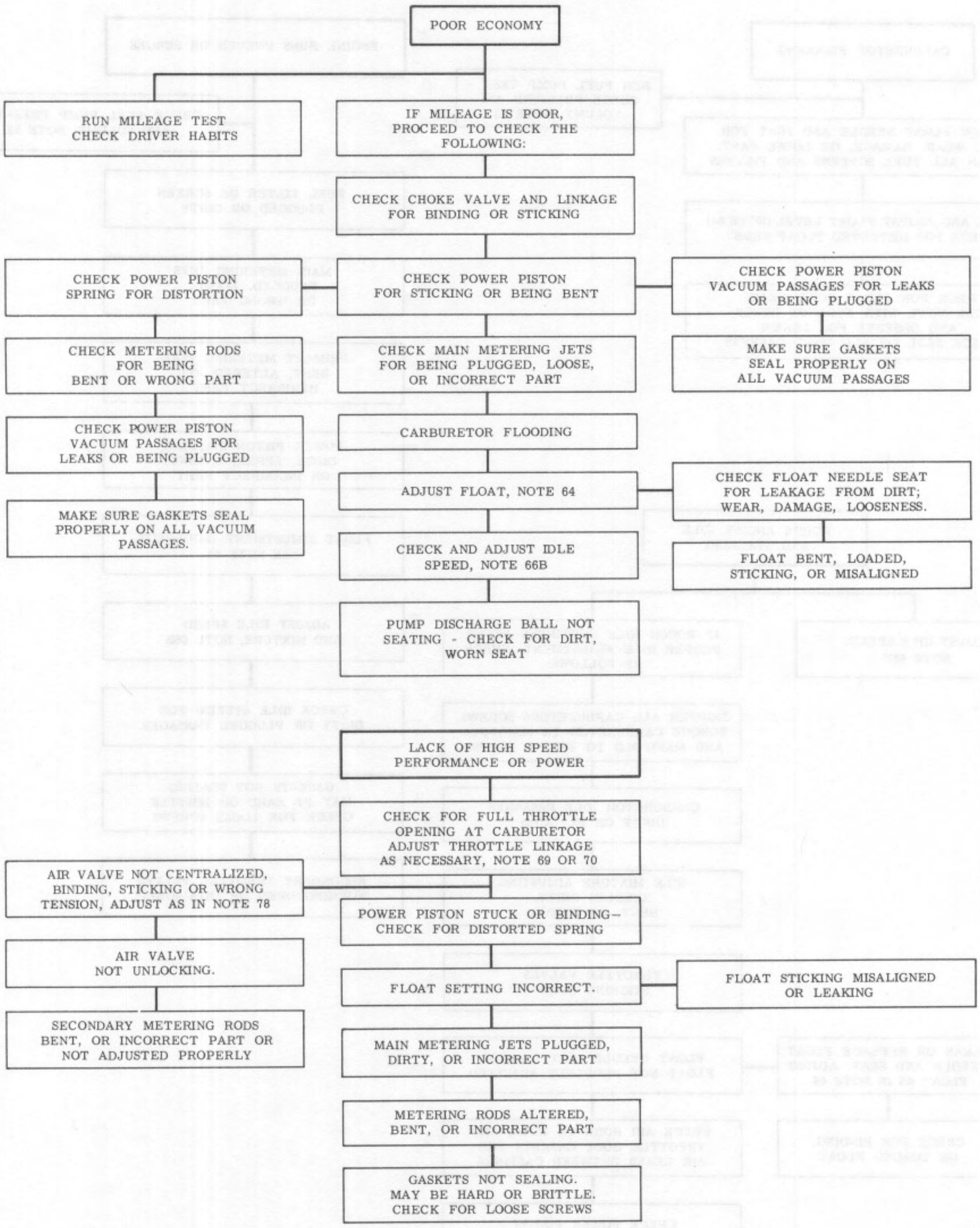


eccentric for wear using mirror and flashlight through mounting flange, inspect fuel pump arm for wear. A worn arm generally indicates a worn eccentric.

CAUTION: If fuel pump check shows delivery is adequate but car did not perform satisfactorily, check for pinched, damaged, or leaky fuel inlet line and hoses back to the tank and discharge line to carburetor and the vapor return line. Check for a plugged filter in the gas tank. Replace damaged or inoperative parts.

8. If pump does not operate properly after these checks have been made, replace pump.

9. When installing pump, crank engine until fuel pump eccentric is at its low point of contact with the fuel pump arm. With mounting screws loose, lift up on pump. Tighten screws to 13 foot-pounds.

10. To check pump discharge pressure, remove hose from carburetor end of fuel line and connect pressure gauge using suitable fittings. At cranking speed, fuel pump pressure should be a minimum of 5 pounds per square inch.

If pump pressure is out-of-specification, replace pump.

11. Remove pressure gauge and connect rubber hose previously used. Remove hose from checking solution and crank engine over, collecting discharged liquid in suitable container until all liquid is pumped out of system.

12. Remove hose from carburetor end of fuel line and reconnect fuel line to carburetor securely using tubing wrench. Be sure carburetor inlet nut is tight. Be careful not to disconnect any vacuum hoses or tees at the carburetor.

13. Remove coil jumper wire or connect HEI.

14. Raise car and remove rubber hose from inlet side of pump and re-connect flexible hose attached to fuel line.

15. Unclamp vapor return line.

16. Lower car, start engine and check for fuel leaks.

SERVICE INFORMATION QUADRAJET CARBURETOR

54. Carburetor Removal and Installation

a. Removal

1. Disconnect Automatic Level Control hose from elbow on air cleaner base if so equipped.

2. Remove air cleaner cover and crankcase ventilating breather. Disconnect sensor vacuum hose at manifold tee.

3. Remove air cleaner and heat tube as a unit.

4. Disconnect fuel line at carburetor. Use a 1" tubing wrench, J-23443, if necessary to keep the inlet nut from turning using tubing wrench on fuel line nut.

5. Disconnect vacuum hose from choke re-indexing diaphragm.

6. Disconnect choke coil rod from carburetor by removing two choke housing to manifold attaching screws. Carefully lift choke coil assembly out of pocket. Remove rod from hole in lever.

7. Disconnect the following vacuum hoses or lines from front and rear of carburetor: spark vacuum, canister purge, power brake, transmission modulator, exhaust gas recirculation valve (E.G.R.) and rubber tee between manifold vacuum tube in bowl and vacuum break unit.

8. Disconnect throttle return spring and throttle cable at throttle adapter plate. Disconnect Cruise Control chain if car is so equipped.

9. Remove transmission downshift switch as described in Section 7, Note 4a.

10. Remove two front screws and two rear screws that hold carburetor to intake manifold and lift carburetor off manifold slightly. Release PCV valve hose clamp attached to front of carburetor and remove hose from fitting.

11. Remove carburetor and gasket. Discard the carburetor gasket.

b. Installation

1. Clean surface of intake manifold and carburetor of any dirt, carbon or gasket material.

2. Place new carburetor gasket on top of manifold with side marked "Top" or with manufacturer's trade mark facing up.

3. Connect PCV valve hose to fitting on front of carburetor and secure with clamp.

4. Position carburetor on intake manifold.

5. Install four mounting screws to intake manifold. Tighten screws evenly. Tighten front screws to 11 foot-pounds and rear screws to 15 foot-pounds.

(NOTE: This torque must be as specified to allow for accurate installation of calibrated choke coil rod.)

6. Connect spark vacuum hose to spark nipple and exhaust gas recirculation valve (E.G.R.) hose to E.G.R. tube. Install tee between vacuum break unit and manifold vacuum tube in bowl. Connect power brake and transmission modulator lines to rear of carburetor. If inverted flared tube connector in throttle body has been replaced or is loose do not tighten to greater than 125 inch pounds as distortion of the throttle body may occur. Connect canister purge hose to fitting at front of throttle body.

7. Install choke coil rod into vacuum break lever as the choke assembly is installed to the manifold. Secure choke assembly to manifold with attaching screws. Attach vacuum hose to re-indexing diaphragm.

8. Install transmission downshift switch as described in Section 7, Note 4b.

9. Connect carburetor fuel line at carburetor and tighten all threaded fittings securely.

10. Connect throttle linkage and return spring.

11. Connect Cruise Control chain if so equipped.

12. If removed, place air cleaner gasket in position and install base of air cleaner on carburetor.

13. Connect vacuum hose at bottom of air cleaner to vacuum tee at rear of manifold.

14. Install crankcase ventilating breather into grommets in air cleaner base and left hand rocker arm cover.

15. Connect hot air duct between exhaust manifold stove and air cleaner.

16. Install air cleaner element and cover; secure with nut.

17. Connect Automatic Level Control hose to small elbow on air cleaner if car is so equipped.

55. Air Horn Removal

1. Remove secondary locknut guard by removing one self-tapping screw and one intermediate length air horn screw.

2. Remove horseshoe clip from upper end of choke rod, disconnect choke rod from upper choke shaft lever and remove choke rod from bowl. Use a thin screwdriver to push the lower choke lever outward to help remove the rod.

3. Using a pin punch, carefully drive accelerator pump roll pin out of boss only enough to lift pump arm out of way.

4. Remove secondary metering rod hanger screw and remove metering rods with hanger.

5. Remove remaining air horn to bowl attaching screws, two long screws, four short screws, two countersunk screws. Two countersunk attaching screws are located inside air horn next to the primary venturi.

6. Lift air horn off bowl and twist to disengage vacuum break rod from air valve shaft. Air horn gasket should remain on bowl for removal later.

7. Remove vacuum break rod from vacuum break diaphragm plunger.

CAUTION: Care must be taken not to bend the small tubes protruding from air horn, Fig. 6-78. These are permanently pressed into the casting.

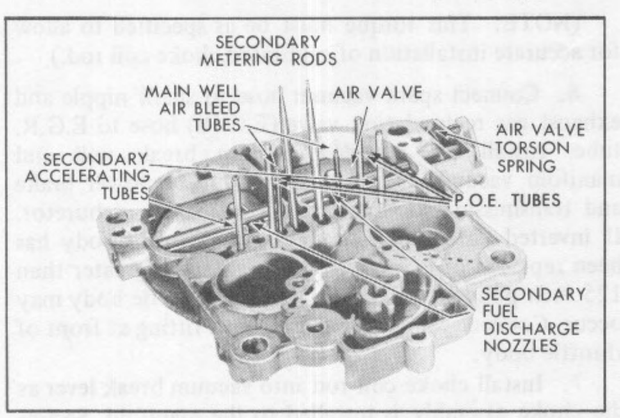


Fig. 6-78 Air Horn Assembly

56. Air Horn Disassembly

(NOTE: Further disassembly of the air horn is not required for cleaning purposes and is not recommended. If part replacement is required, proceed as follows:)

1. Remove choke valve attaching screws and then remove choke valve and shaft.

2. Remove pump lever roll pin.

3. Remove air valve lockout lever roll pin and remove lever.

CAUTION: Air valves and air valve shaft are calibrated and should not be removed. However, should it be necessary to replace the plastic air valve cam on the air valve shaft, a repair kit is available which includes the plastic cam, closing spring, pin, screw and instructions.

57. Float Bowl Disassembly

1. Remove air horn assembly as described in Note 55.

2. Remove accelerator pump plunger from pump well, Fig. 6-79.

3. Remove air horn gasket from dowels on secondary side of bowl, then remove gasket from around power piston and primary metering rods.

4. Remove pump return spring from pump well.

5. Remove plastic filler over fuel inlet needle and seat.

6. The power piston can be removed by pressing the piston down and releasing it. This will cause the power piston spring to snap the piston up against the retainer. In some cases this may have to be repeated several times. Remove power piston retainer clip and remove power piston and primary metering rods. Fig. 6-80. Remove power piston spring from well.

7. Remove metering rods from power piston by disconnecting tension spring from top of each rod, then rotating rod to remove from hanger. See inset of Metering Rod Assembly, Fig. 6-84. Identify metering rods so that they may be reinstalled in the same jets from which they were removed.

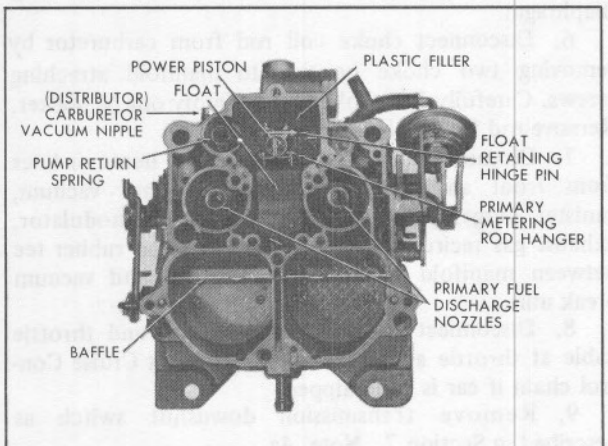


Fig. 6-79 Float Bowl Assembly

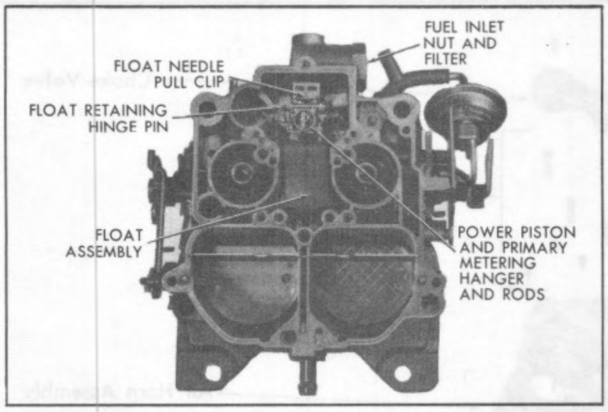


Fig. 6-80 Float Bowl Partially Disassembled

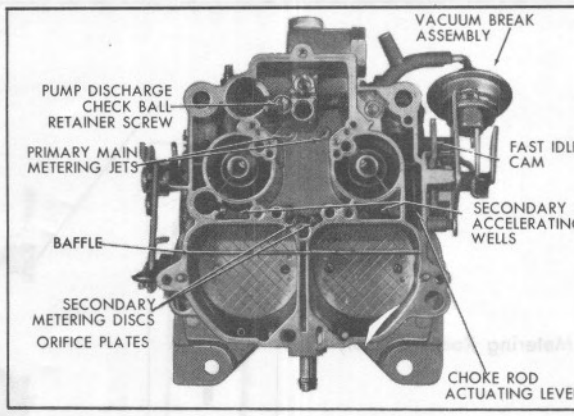


Fig. 6-82 Float Bowl Disassembled

8. Remove float assembly and inlet needle by pulling up on retaining hinge pin. Do not remove inlet needle seat unless it is damaged, in which case it and fuel needle must be replaced as an assembly. If needle seat is to be removed, use Fuel Inlet Needle Seat Remover, J-22769, Fig. 6-81.

9. Do not remove primary metering jets, Fig. 6-82 unless damaged or worn. No attempt should be made to remove secondary metering plates. If jets are removed but not replaced, they should be installed in the same hole from which they were removed.

10. Remove pump discharge check ball retainer screw and check ball.

11. Remove vacuum hose from vacuum break assembly and from tube connection on bowl if not previously removed.

12. Remove retaining screw from vacuum break assembly and remove assembly from float bowl.

(NOTE: If further disassembly of vacuum break mechanism is necessary, spread the retaining ears on bracket next to vacuum break assembly, then remove vacuum break assembly from bracket.)

13. Remove choke rod actuating lever from inside of float bowl well.

14. Remove fuel inlet nut with attached gasket and strainer.

15. Turn bowl over and remove throttle body by removing two throttle body to bowl attaching screws. See Fig. 6-83.

(NOTE: Be careful when inverting bowl assembly as smallest venturi protrudes beyond the gasket surface.)

16. Remove throttle body to bowl insulator gasket.

58. Throttle Body Disassembly

1. Remove pump rod from throttle lever by rotating rod out of lever.

2. Due to the addition of the idle mixture limiter caps, they should not be removed unless it is necessary to replace the mixture needles or clean the idle passages. If the idle mixture needles are removed, adjustment procedures are covered in Note 66. These should not be installed on the idle mixture needles until the mixture has been set according to instructions in Note 66.

CAUTION: Extreme care must be taken to avoid damaging throttle valves.

CAUTION: No further disassembly of the

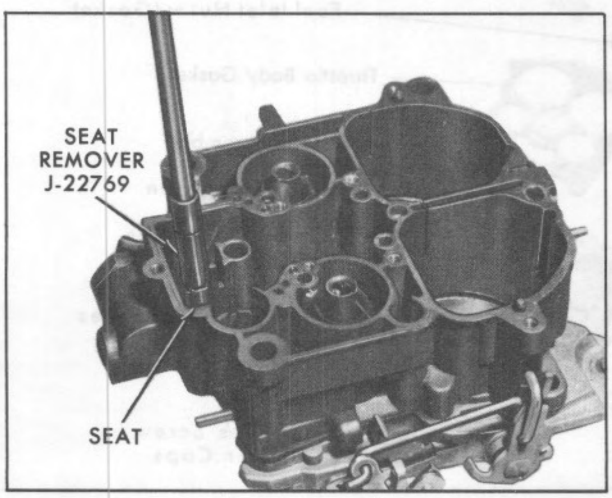


Fig. 6-81 Removing Needle Valve Seat

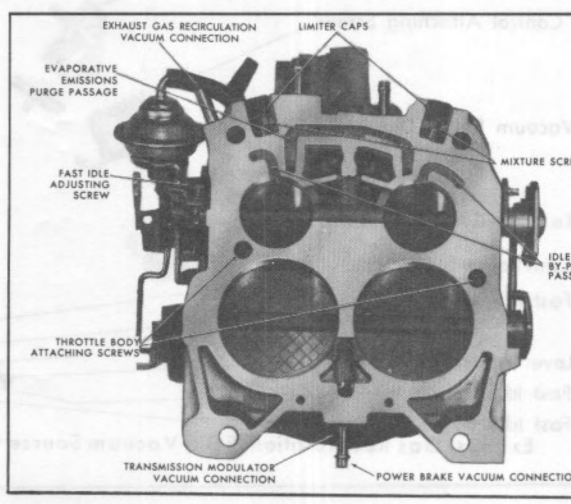


Fig. 6-83 Throttle Body

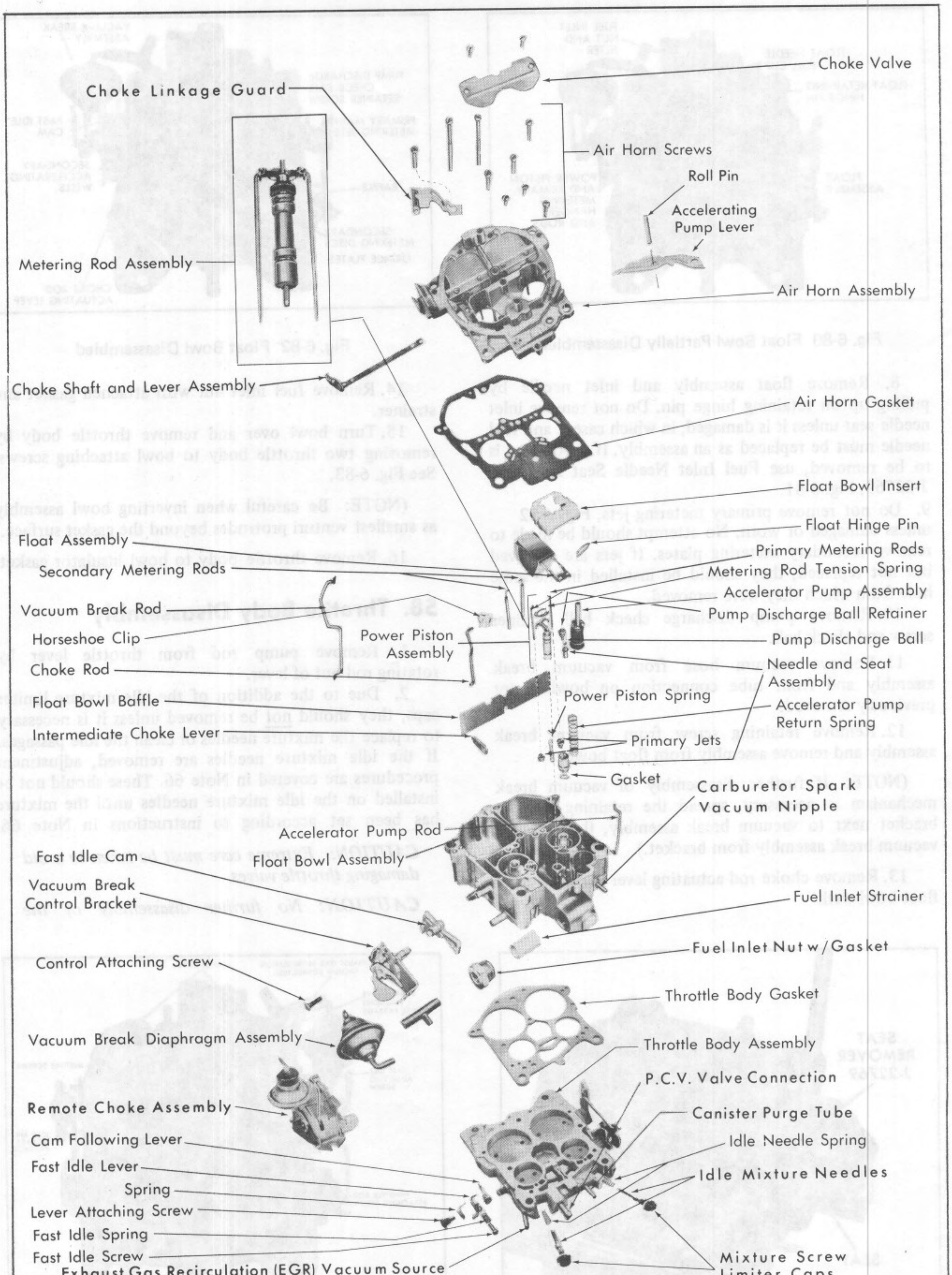


Fig. 6-84 Quadrajet Exploded View

throttle body is required or desirable. Under no circumstances should the plug at the front of the throttle body be removed to adjust the screw behind it. The screw is factory set to control exhaust emission and pass U.S. Government standards. A new throttle body should be installed if any damage to the existing throttle body is encountered. Refer to Note 57 when installing throttle body.

59. Carburetor Cleaning and Inspection

1. Thoroughly clean carburetor castings and metal parts, Fig. 6-84 in an approved cold immersion type carburetor cleaner.

CAUTION: Rubber parts, plastic parts, pump plungers, vacuum break diaphragm and the choke vacuum re-indexing unit should NOT be immersed in carburetor cleaner because they may be damaged. However, the cam on the air valve shaft will withstand normal cleaning in carburetor cleaner.

2. Blow out all passages in castings with compressed air. Do not pass drills through jets or passages.
3. Inspect idle mixture needles for damage.
4. Examine fuel inlet needle and seat for wear. Replace, if necessary, with new needle and seat assembly.
5. Inspect upper and lower surface of carburetor castings for damage.
6. Inspect holes in levers for excessive wear or out of round conditions. If worn, levers should be replaced.
7. Examine fast idle cam for wear or damage.
8. Check air valve for binding conditions.
9. Check all throttle levers and valves for binds or other damage.
10. Clean plastic parts only in washing gas or kerosene.

Carburetor Assembly

60. Throttle Body Assembly

1. If removed, install idle mixture needles and springs until lightly seated. Back out needle 6 turns as a preliminary idle mixture adjustment. Do not install plastic idle limiter caps. A final adjustment must be made on the engine using the procedure described in Note 66.
2. Install lower end of pump rod into throttle lever by aligning tang on rod with slot in lever. End of rod should point outwards towards throttle lever.

61. Float Bowl Assembly

1. Install new throttle body to bowl insulator gasket on bowl, being certain gasket is properly positioned over two locating dowels.
2. Install throttle body, making certain that it is properly located over dowels on float bowl; then install two throttle body to bowl screws and tighten evenly and securely.

(NOTE: If a new (service) throttle body is used, be sure to perform step 19, of this note.)

Place carburetor on proper holding fixture.

3. Install fuel inlet strainer, and inlet nut with attached gasket. Tighten nut securely.
4. If vacuum break diaphragm was removed from bracket slide vacuum break diaphragm between retaining ears and bend ears down slightly to hold securely.
5. Install fast idle cam on vacuum break assembly. Be sure arm of vacuum break lever is located beneath the tail of fast idle cam.
6. Connect choke rod (plain end) to choke rod actuating lever, then -- holding choke rod with grooved end pointing inward -- position choke rod actuating lever in well of float bowl and install choke assembly, engaging shaft with hole in actuating lever. Install retaining screw and tighten securely. Remove choke rod from lever for installation later.
7. Install vacuum hose tee to connections on bowl and vacuum break assembly if removed.
8. Install pump discharge check ball and retainer screw in passage next to pump well.
9. If fuel inlet needle seat was removed, use new needle seat gasket and position new seat on Fuel Inlet Needle Seat Remover and Installer, J-22769. Carefully screw needle seat into float bowl, Fig. 6-81.
10. Install main metering jets. If removed, the jets should be installed in the same hole from which they were removed.
11. Install fuel inlet needle and pull clip.
12. Install float by sliding float lever under float needle pull clip. Pull clip should be positioned on the hinge pin side. With float lever in pull clip, hold float assembly at toe and install hinge pin from pump well side.

CAUTION: Do not place pull clip through small holes in top of float arm. Severe flooding will result.

13. Perform float level adjustment as described in Note 64.
14. Install power piston spring in power piston well. If primary main metering rods were removed from hanger, reinstall, making sure that tension spring is connected to top of each metering rod. See Fig. 6-84. Rods must be positioned so they are installed in the same position from which they were removed. Install power piston assembly in well and metering rods properly positioned in metering jets. Install power piston retainer securely in power piston bore.
15. Install plastic filler over fuel inlet needle, pressing downward until seated properly.
16. Install pump return spring in pump well.
17. Install air horn gasket around primary metering rods and piston. Position gasket over two dowels on secondary side of bowl.
18. Install pump plunger in pump well to complete float bowl assembly.

19. Whenever a service throttle body is installed, the adjustment procedures included in the instruction sheet must be followed carefully:

a. At the front of the throttle body, recessed in the center, an adjusting screw is visible. This screw is plugged off except on service throttle bodies.

b. After adjusting the screw according to the instructions, install the welsh plug, furnished with the throttle body, over the adjusting screw and stake in place to conceal the screw.

c. Proceed with the remaining carburetor adjustments.

62. Air Horn Assembly

1. Install the following, if removed: choke shaft, choke valve and two attaching screws, air valve lockout lever and roll pin. Check for free operation.

(NOTE: The choke valve screws have a special sealing compound to hold them in place. If removed, they should be lightly staked after tightening.)

63. Air Horn to Bowl Assembly

1. Install vacuum break rod into vacuum break diaphragm plunger.

2. Insert vacuum break rod in slot of air valve shaft and twist air horn into position.

3. Lower air horn assembly to bowl carefully, positioning vent tubes and accelerating well tubes through air horn gasket.

4. Install two long air horn screws, three black short screws, one intermediate length light colored screw and two countersunk screws in primary venturi area. Special light colored screw is installed in position #3, Fig. 6-85.

5. Connect choke rod in lower choke lever and retain in upper lever with horseshoe clip.

(NOTE: Be sure choke rod is located under lockout tang before installing clip.)

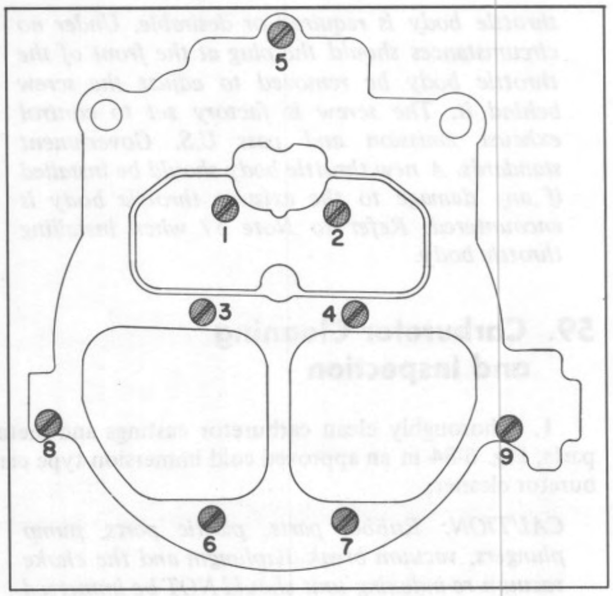


Fig. 6-85 Air Horn Screws Tightening Sequence

6. Install air valve lock-out guard under intermediate length screw (#4 in Fig. 6-85) and secure with self-tapping screw. To prevent binding of choke valve or air valve due to distortion of air horn, tighten all screws evenly, using sequence shown in Fig. 6-85.

7. Connect upper end of pump rod into correct hole in accelerator pump lever and position pump lever in boss on air horn. Using a sharp bladed screwdriver, push roll pin back through lever until flush with boss. If roll pin is damaged, install new pin from front.

8. Install secondary metering rods into secondary metering rod hanger (upper ends or rod point towards each other). Install secondary metering rod hanger onto air valve cam follower. Install remaining screw and tighten securely. Work air valves up and down several times to make sure they are free in all positions and have satisfactory end movement.

MAINTENANCE ADJUSTMENTS ON CAR

64. Float Adjustment (Fig. 6-86)

1. Remove air horn assembly as described in Note 55.

2. With adjustable T-scale, measure from top of float bowl gasket surface, with gasket removed, to top of float at toe, Fig. 6-86. Locate gage point 1/16" from radius on toe.

3. Hold retaining pin firmly in place with tang of float lightly seated on float needle.

4. Scale dimension should be 1/4 (.250 inch) for all except Eldorado and Commercial; 23/64 (.360 inch) for Eldorado only and 19/64 (.290) for Commercial vehicles.

5. Bend float up or down to obtain proper measurement.

6. Install air horn assembly as described in Note 63.

65. Choke-Coil Rod Adjustment (On Car) (Fig. 6-87)

1. Remove choke assembly from manifold to disengage choke coil rod from vacuum break lever.

2. Reinstall choke coil assembly but do not install choke coil rod into hole in vacuum break lever.

3. With choke valve completely closed, fast idle cam in cold start position and vacuum break lever in maximum upward position, pull choke coil rod upward to end of travel against stop in choke coil housing. Upper end of rod should be positioned with respect to engaging hole as shown in Fig. 6-87. (The bottom of the

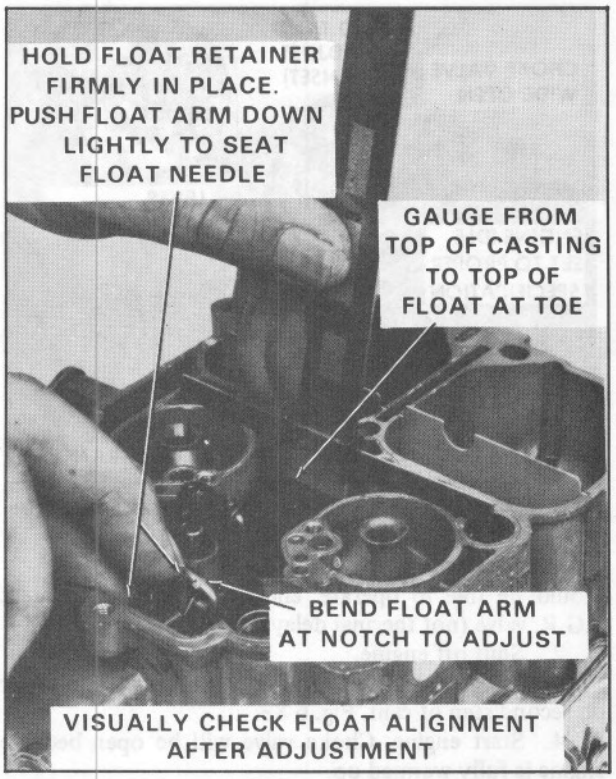


Fig. 6-86 Float Level Adjustment

rod should be tangent to the top edge of the hole. Do not use the notches in the lever for gaging.

4. Bend choke-coil rod to adjust for position as described in Step 3.

5. Remove choke coil assembly from manifold. Reinstall by putting upper end of choke coil rod into hole in vacuum break lever, rotate assembly downward, open throttle and slide assembly in place. Tighten coil assembly to manifold.

66. Idle Mixture and Speed Adjustments (On Car)

a. Mixture Adjustment

The following procedure should not be considered part of a normal tuneup. The plastic limit caps permit idle mixture screws to be adjusted leaner without breaking the cap. At 24,000 miles, if CO is high, the mixture may be adjusted within the limits of the caps. If idle CO cannot be reduced to specifications the stop tang must be cut off the limiter cap and mixture readjusted.

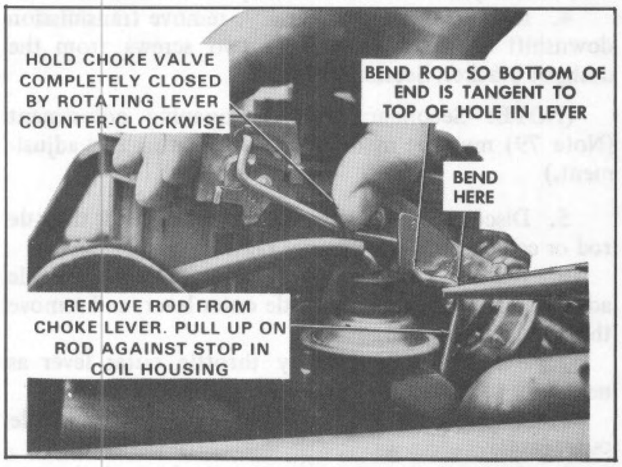


Fig. 6-87 Choke Coil Rod Adjustment

CAUTION: Do not bend the mixture screws when cutting the tang.

(NOTE: Before idle mixture adjustment is made, distributor vacuum advance hose must be disconnected at the distributor and plugged to eliminate the possibility of advancing the timing and increasing engine rpm. The basic engine timing should be set at 10° BTDC.)

1. Disconnect parking brake vacuum hose at vacuum release cylinder and plug hose. Disconnect air leveling compressor hose at air cleaner and plug hose. Remove air cleaner but keep vacuum hoses connected.

(NOTE: Hoses must be disconnected at these locations to include any calibrated leakage in balance of system.)

2. Connect tachometer to engine, set parking brake securely and block wheels. Place transmission selector lever in Neutral.

3. Mixture screws should be out 4 turns from seated position. Start and warm engine to normal operating temperature. Be sure that choke is fully open and that carburetor is on slow idle with primary and secondary throttle valves closed.

4. Place transmission selector lever in either "DR" position and turn A/C off.

5. Set idle speed to 640 rpm by adjusting anti-dieseling solenoid.

6. Using Extension Hex-Head Driver, J-22646, turn alternately each mixture screw inward 1/4 turn at a time until the 600 rpm speed is reached.

7. Check for proper operation of solenoid. Replace solenoid if inoperative.

8. Idle mixture and speed adjustment is now complete. Idle speed should be 600 rpm.

9. Shut off engine and remove tachometer.

10. Connect parking brake vacuum line.

11. Connect distributor and ALC vacuum lines.

12. Install air cleaner.

b. Idle Speed Adjustment

Normal engine idle speed is no longer adjusted with the commonly used idle speed screw but with an anti-dieseling solenoid. To make an idle speed adjustment the engine must be running; this energizes the solenoid and permits the solenoid plunger to move out.

The solenoid is not strong enough to open the throttle when energized, but if the throttle is opened slightly, this allows the plunger to move out completely and the plunger will keep the throttle open at the adjusted idle speed.

(NOTE: This solenoid has improved adjustment accessibility. Adjustment is made by turning the hex nut on the plunger at the rear of the solenoid.)

When the ignition is turned off the solenoid plunger retracts and the throttle lever comes to rest against the low speed idle adjusting screw.

(NOTE: Before low idle speed adjustment is made, distributor vacuum advance hose must be disconnected at the distributor and plugged to eliminate the possibility of advancing the timing and increasing engine rpm. Hose must be disconnected at this location to include any calibrated leakage in balance of system. Basic engine timing at idle should be 10 degrees before top center. Reset before making idle speed adjustment.)

Mixture adjustment must be correct before idle speed setting can be made.

1. Disconnect parking brake hose at vacuum release cylinder and plug hose. Set parking brake and block wheels. Disconnect air leveling compressor hose at air cleaner and plug hose.
2. Connect tachometer, start and warm-up engine to operating temperature in park. Choke should be fully open and throttle completely off the fast idle cam.
3. Place transmission selector lever in drive, turn air conditioning off and disconnect wire to anti-dieseling solenoid. Plunger should be retracted and not hold throttle open.
4. Adjust idle speed screw on carburetor to give 350-400 rpm.
5. Reconnect solenoid wire, crack throttle slightly to extend plunger fully. Turn adjustment nut on plunger at rear of solenoid to provide a 600 rpm idle in drive with A/C off.
6. Shut off engine. Remove tachometer.
7. Reconnect all disconnected hoses.

67. Fast Idle Adjustment (On Car) (Fig. 6-88)

(NOTE: Preceding idle adjustments must be made first. Automatic Climate Control should be in "Off" position on cars so equipped.)

1. Start engine and allow engine and transmission to reach operating temperature; choke should be fully open. Be sure parking brake is applied. E.G.R. valve

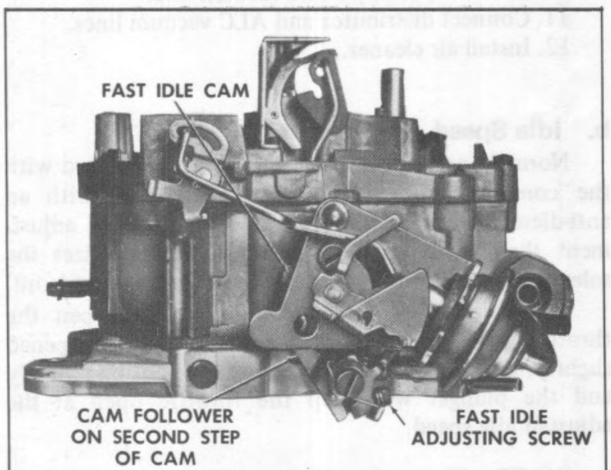


Fig. 6-88 Fast Idle Adjustment (On Car)

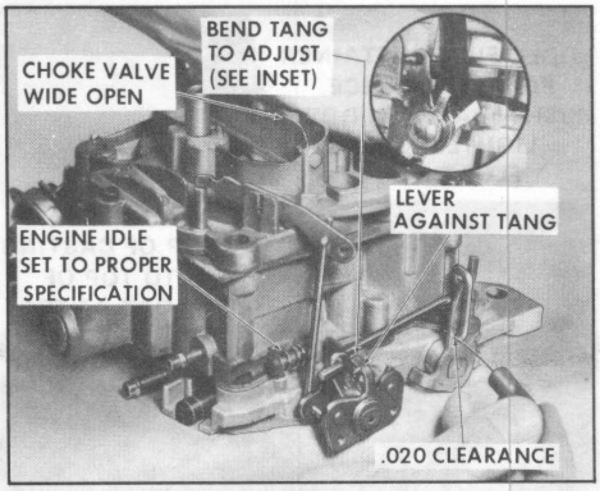


Fig. 6-89 Secondary Throttle Closing Adjustment (On Car)

should be free to operate, check for vacuum signal at E.G.R. valve (not thermal delay valve).

2. Shut off engine.
3. Open throttle slightly. Set fast idle cam follower on second step of cam, Fig. 6-88.
4. Start engine. Choke valve will be open because engine is fully warmed up.
5. Observe idle speed and adjust fast idle screw, Fig. 6-88, to give 1200-1250 rpm with transmission in Neutral. Return engine to normal idle.

68. Secondary Throttle Closing Adjustment (On Car) (Fig. 6-89)

1 Set low speed idle screw to 400 rpm, as described in Note 66, making sure cam follower is not resting on fast idle cam and anti-dieseling solenoid is disconnected.

2. There should be .020" clearance between actuating rod and front of slot in secondary throttle lever as shown in Fig. 6-89, when primary throttle middle lever is against tang of primary throttle outer lever.

3. If adjustment is correct, replace air cleaner.

4. If adjustment is necessary, remove transmission downshift switch by removing two screws from the dashpot bracket. Section 7, Note 4a.

(NOTE: Secondary throttle opening adjustment (Note 79) must be made before attempting this adjustment.)

5. Disconnect throttle return spring and throttle rod or cable at throttle adapter plate.

6. Remove cross head recess screws holding throttle adapter plate to primary throttle outer lever, and remove throttle adapter plate.

7. Bend tang of primary throttle outer lever as necessary to adjust.

8. Attach throttle adapter plate to primary throttle outer lever.

9. Connect throttle return spring(s) and throttle rod or cable at throttle adapter plate.

10. Install transmission downshift switch assembly and adjust as described in Section 7, Note 4b.

11. Connect anti-dieseling solenoid.

12. Install air cleaner.

69. Throttle Cable Adjustment (Except Eldorado)

1. Remove air cleaner.
2. Check linkage for free movement in all positions, and check to see that return spring fully closes the throttle.
3. Remove retainer that holds end of throttle cable in relay lever, and remove from relay lever.
4. On cars equipped with Cruise Control, detach Cruise Control clip at throttle lever and remove chain from throttle pivot.
5. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.
6. Turn throttle cable end in either direction as necessary to allow free entry into relay lever, Fig. 6-90.
7. With accelerator pedal released, reinstall retainer on throttle pin on relay lever.
8. Recheck for fully closed throttle. With accelerator pedal pressed again to floor mat, recheck throttle for wide open position.
9. On cars equipped with Cruise Control, install Cruise Control linkage and secure with clip.

70. Throttle Cable Adjustment (Eldorado)

1. Remove air cleaner.
2. Check cable linkage for free movement in all positions, and check to see that return spring fully closes throttle.
3. Disconnect cable retaining clip at throttle adapter plate and remove cable from adapter plate.
4. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.
5. If cable fitting does not line up exactly with its connecting pin on throttle adapter plate, loosen two nuts at cable mounting plate on left rear of carburetor, and position cable backward or forward to allow exact alignment into throttle adapter plate hole, Fig. 6-91.
6. Tighten cable mounting screws on mounting plate.

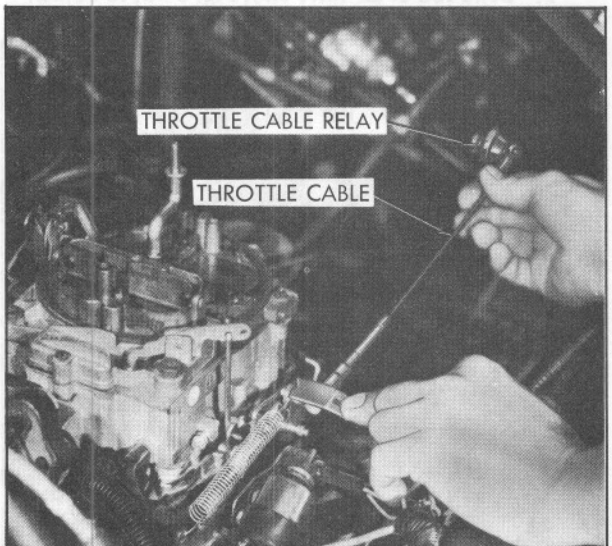


Fig. 6-90 Throttle Cable Adjustment (Except Eldorado)

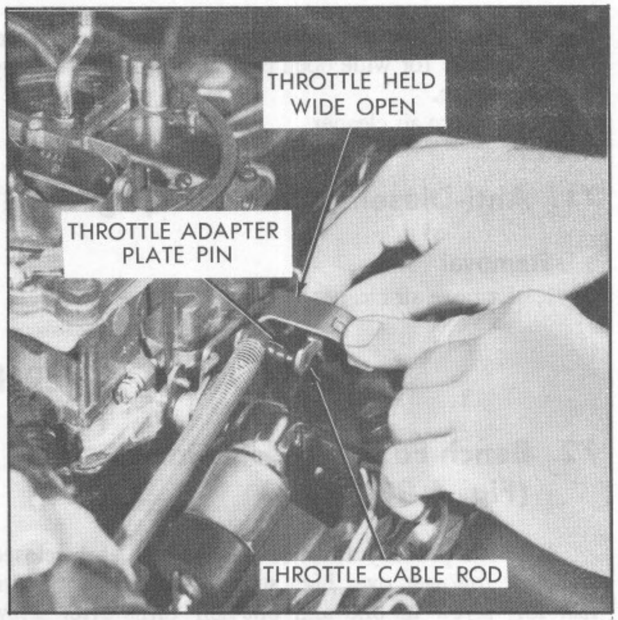


Fig. 6-91 Throttle Cable Adjustment (Eldorado)

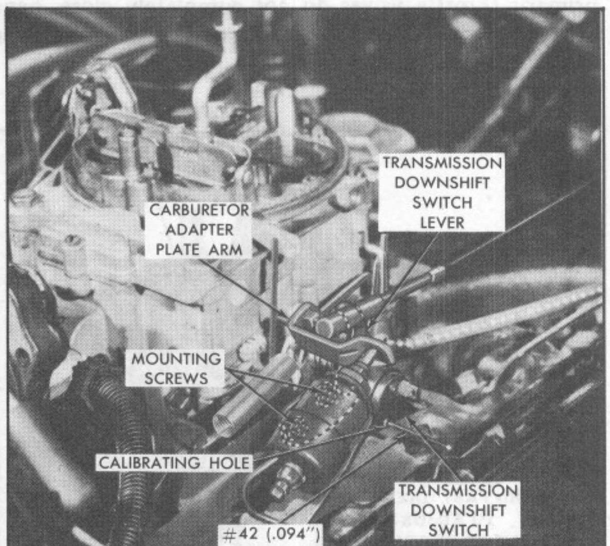


Fig. 6-92 Adjusting Anti-Dieseling Solenoid

7. With accelerator again pressed to floor mat, recheck throttle for wide open position. Recheck for fully closed throttle.

8. Replace air cleaner.

71. Anti-Dieseling Solenoid (Fig. 6-92)

a. Removal

1. Remove air cleaner.
2. Disconnect solenoid from harness at connector.
3. Remove locknut securing solenoid to bracket, Fig. 6-92, and remove solenoid from bracket.

b. Installation

1. Install solenoid into bracket from front of engine, Fig. 6-92.
2. Install locknut on solenoid shaft and tighten.
3. Adjust solenoid as described in Note 66b.
4. Install air cleaner.

MAJOR OVERHAUL ADJUSTMENTS

72. Bench Fast Idle Adjustment (Fig. 6-93)

1. With primary throttle valves completely closed and cam follower over high step of fast idle cam, turn fast idle screw in one and one-half turns after screw makes contact on lever, Fig. 6-93. Final adjustment must be made on car.

73. Pump Rod Adjustment (Fig. 6-94)

1. With slow speed idle adjusting screw backed out of contact, throttle valves completely closed and pump rod in correct hole of pump lever, measure from top of choke valve wall, next to vent stack, to top of pump stem with adjustable T-scale.

2. Bend pump lever at pump end with an adjustable wrench, while holding other end of lever with 7/16" open end wrench, Fig. 6-94, to adjust. Dimension should be 1/4" (.250) for all except commercial vehicles and altitude carburetors. Commercial vehicles and altitude carburetors should be 11/32" (.344).

(NOTE: Be sure secondary actuating rod is not keeping the primary throttle valves from closing. If the primary throttle valves do not completely close, bend the secondary closing tang out of position and then readjust after pump adjustment.)

74. Choke Rod Adjustment (Fig. 6-95)

1. Bench fast idle adjustment, Note 72, must be made before choke rod adjustment is made.
2. With bench fast idle adjustment made, cam follower on second step of fast idle cam and against high step of cam, rotate the choke valve toward the closed position by pushing up on vacuum break lever.
3. With choke rod at bottom of choke lever slot, dimension between lower edge of choke valve and air horn should be .110 inch.
4. Bend choke rod, Fig. 6-95, to adjust.

75. Air Valve Dashpot Adjustment (Fig. 6-96)

1. Seat the vacuum break diaphragm using outside vacuum source. With the vacuum break diaphragm seated, there must be clearance of .030 inch between the dashpot rod and end of slot in air valve lever. Make sure spring loaded diaphragm plunger is fully in and seated and stem is not pulled out.
2. Bend rod at air valve end, Fig. 6-96, to adjust.

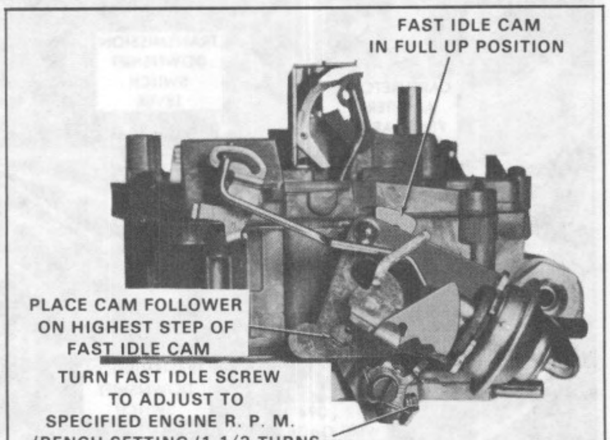


Fig. 6-93 Fast Idle Adjustment (On Bench)

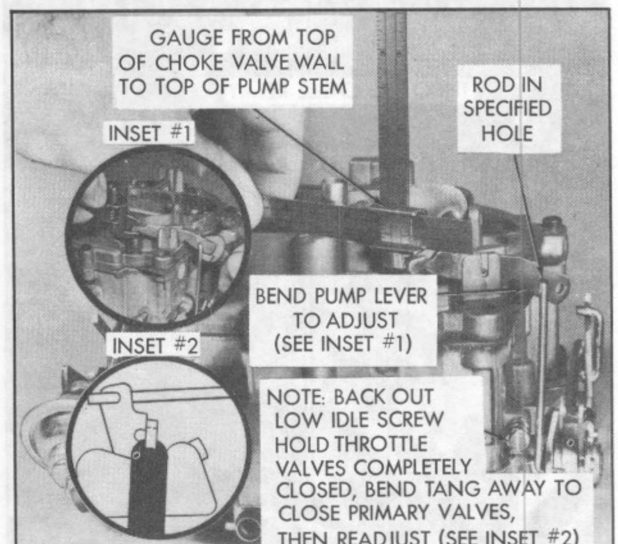


Fig. 6-94 Accelerator Pump Adjustment

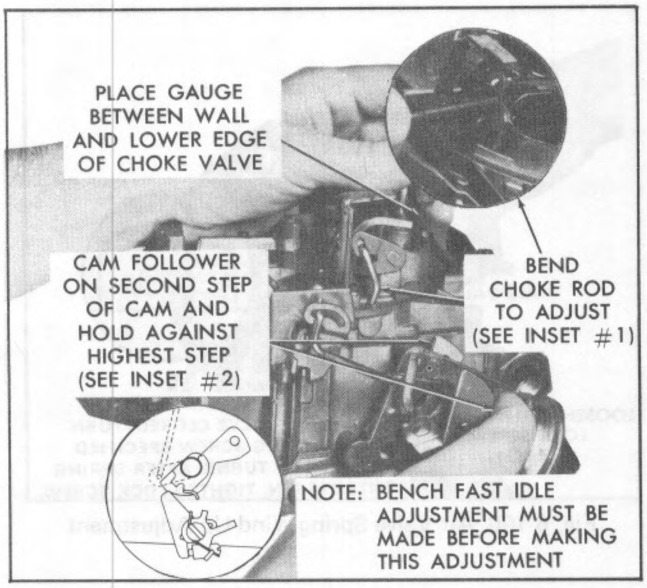


Fig. 6-95 Choke Rod Adjustment

(NOTE: The diaphragm may be seated by attaching a 3/16" I.D. rubber hose from the vacuum break unit diaphragm nipple, to any available external source supplying a vacuum of at least 6" hg. Oral vacuum will produce sufficient vacuum to seat the diaphragm.)

76. Vacuum Break Adjustment (Fig. 6-97)

(NOTE: Use of an external vacuum source (vacuum pump, oral vacuum, etc.) is required when adjusting vacuum break assemblies.)

1. Bench fast idle adjustment, Note 72, choke rod adjustment, Note 74, and air valve dashpot adjustment, Note 75, must be made before this adjustment.
2. Open throttle valve and set fast idle cam on the high step.
3. Install a rubber band to the vacuum break lever and some portion of the air horn near the secondary air

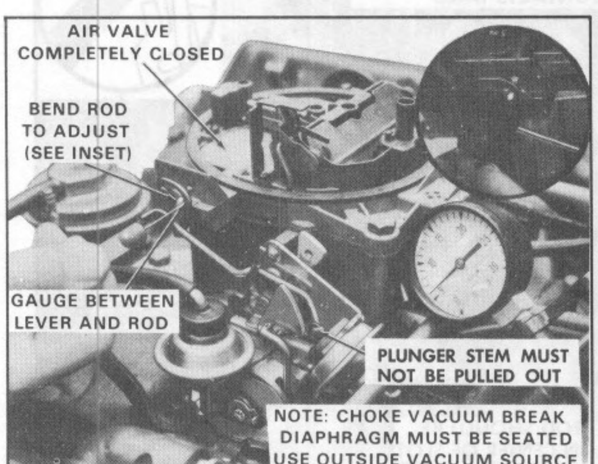


Fig. 6-96 Air Valve Dashpot Adjustment

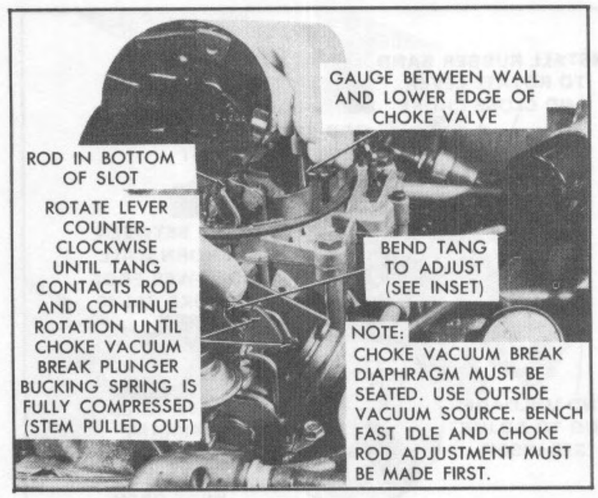


Fig. 6-97 Vacuum Break Adjustment

valve so that the tang of the vacuum break lever will be pulled rearward, contacting the vacuum break rod when vacuum is applied to the vacuum break unit.

(NOTE: This procedure is necessary to make certain that only diaphragm link, Fig. 6-97, to which the vacuum break rod is attached is in the extended position (toward rear of engine) while the diaphragm is in the fully seated position when the adjustment is being made.)

4. Disconnect rubber tee from vacuum break unit.
5. Connect a short (15" - 20") piece of 3/16" I.D. rubber hose to the nipple on vacuum break unit.
6. Apply vacuum from an external source to the nipple of the vacuum break unit until the diaphragm is seated and the diaphragm link is in the extended position. Maintain vacuum to hold in this position by clamping off the hose.
7. Dimension between the front wall of the air horn and lower edge of choke valve should be 0.185 (3/16") on all cars (including commercial) except Eldorado and .200 inch on Eldorados. All play should be taken out of choke valve by lightly pressing valve toward its open position.

(NOTE: Choke rod should be at the bottom of the choke lever.)

8. Bend vacuum break lever tang, Fig. 6-97, to adjust.

77. Unloader Adjustment (Fig. 6-98)

1. With choke valve held toward closed position by lifting up on vacuum break lever, open primary throttle to wide open position.
2. With valves in this position, take up linkage slack toward open position of valve. Dimension between lower edge of choke valve and air horn wall should be .312 (5/16") inch.
3. Bend tang on fast idle adjusting lever, Fig. 6-98, to adjust.

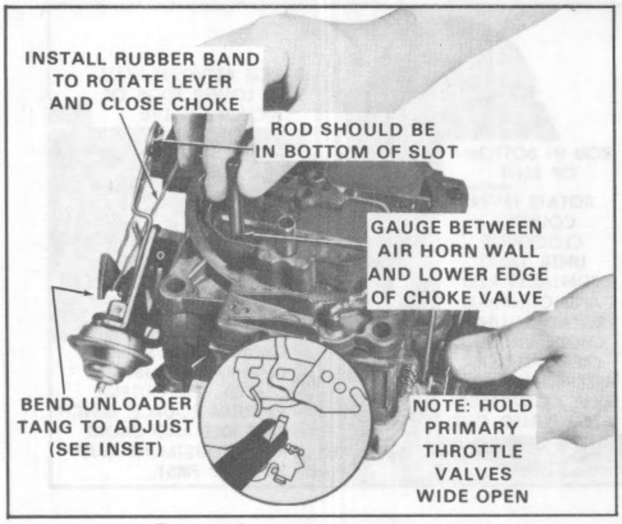


Fig. 6-98 Unloader Adjustment

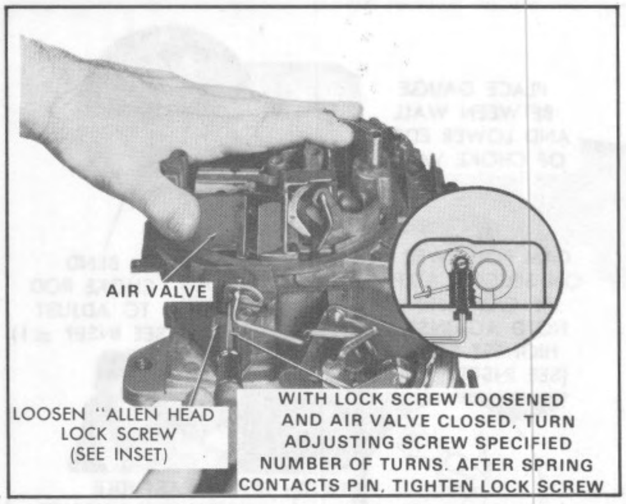


Fig. 6-100 Air Valve Spring Wind-Up Adjustment

78. Air Valve Adjustments

a. Opening Clearance.

(NOTE: Fast idle (off car) and choke rod adjustments must be made prior to this adjustment.)

1. Remove two screws securing lockout guard to air horn and remove air valve lockout guard.
2. With choke valve wide open, apply sufficient downward force to the vacuum break lever to move choke rod to top of slot in choke lever.
3. Move air valve slightly in direction of open valve.
4. Bend upper end of air valve lockout lever tang, Fig. 6-99, if necessary, to give an opening of .015 inch between lockout tang and front edge of air valve.
5. Install air valve lockout guard and secure with two screws.

b. Lockout

1. With the opening clearance adjustments made open choke valve to its wide open position by applying an opening force to "up" side of choke valve.
2. Open throttle slightly and set fast idle adjusting lever on highest step of fast idle cam. Making sure choke rod is in bottom of slot, by applying upward force to vacuum break lever, air valve lockout tang should allow only 6°-10° of air valve opening. During choke-on conditions, (warm-up) the air valve will open only 6°-10° even if throttle is wide open. This angle is not adjustable but is built into the assembly.

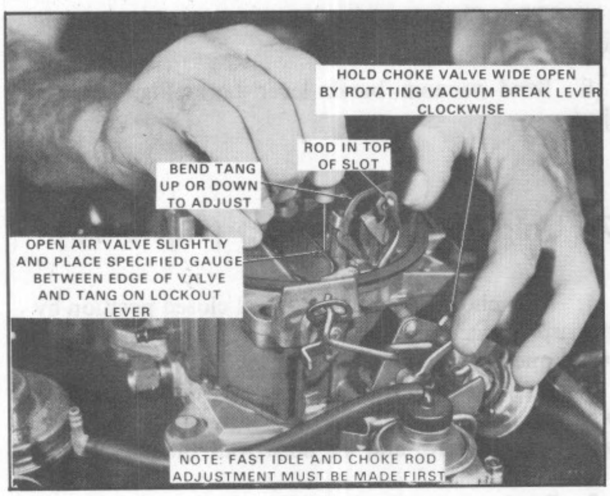


Fig. 6-99 Air Valve Lockout Adjustment

c. Spring Wind-Up

(NOTE: This adjustment must be made only when replacing air valve. During normal overhaul do not remove air valve.)

1. Loosen allen socket head lockscrew, Fig. 6-100, and turn adjusting screw counterclockwise to remove all spring tension.
2. With air valve closed, turn adjusting screw clockwise 1/2 turn on all cars, except altitude cars, after torsion spring contacts pin on shaft. Altitude Eldorado is

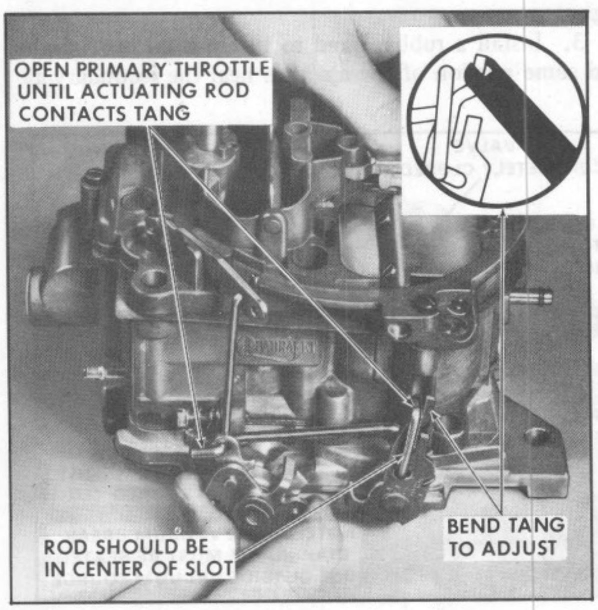


Fig. 6-101 Secondary Throttle Adjustment

Eldorado is 9/16, all other altitude cars is 7/16 turn. Commercial vehicle air valve wind-up is 3/8 turn. Holding adjusting screw in this position, tighten lock-screw.

79. Secondary Throttle Opening Adjustment (Fig. 6-101)

1. Open primary throttle valves until actuating rod contacts tang on secondary throttle lever. With valves in this position, bottom of rod should be in center of secondary throttle lever slot.
2. Bend tang on secondary throttle lever, Fig. 6-101, if necessary to adjust.

80. Secondary Metering Rod Adjustment (Fig. 6-102)

(NOTE: The metering rod hanger is not adjustable. Hangers are selectively matched to each carburetor and letter stamped. Unless the hanger has been damaged no change in hanger setting is necessary. If the hanger has been damaged, an adjustable hanger (holding kit) must be obtained from your servicing Parts Distribution Center and adjusted as described in this note.)

1. To check secondary metering rod adjustment, measure from top of metering rod to top of air horn casting next to air cleaner stud hole, as shown in Fig.

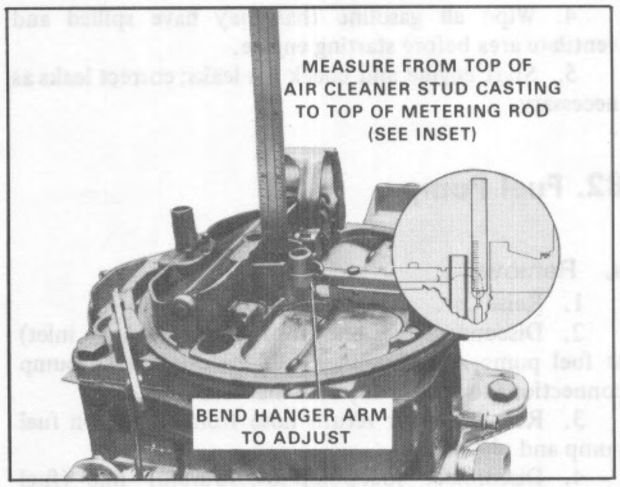


Fig. 6-102 Secondary Metering Rod Adjustment

6-102. This dimension should be .840" or approximately 27/32" for all carburetors.

(NOTE: Be sure to measure metering rod at the point where it enters the hanger. Do not use the bent portion of the rod for this measurement. Air valve must be closed when measurement is taken.)

2. If adjustment is necessary, bend metering rod hanger with pliers at point shown in Fig. 6-102. Make sure both rods are adjusted to same dimension.

SERVICE INFORMATION—FUEL SYSTEM COMPONENTS

(NOTE: Refer to section 8 of this manual for information pertaining to the fuel lines and tank.)

81. Fuel Filter

a. Removal

1. Raise car and clamp or plug the rubber section of the inlet hose to prevent siphoning gas from the tank.
2. Disconnect fuel pump outlet line at fuel pump. Use two wrenches, one to hold large nut while disconnecting the tubing nut with the other wrench (tubing wrench preferred).
3. Using two wrenches again, one to keep from twisting and loosening nut welded to pump cover, the other wrench to loosen and remove outlet fitting which retains the filter.
4. Remove the filter and discard. Use care when removing the nut to avoid damaging the metal gasket. Be careful that the spring surrounding and seating the filter does not fall out of the pump.

b. Installation

1. Position new filter into nut and screw nut into pump, Fig. 6-103. Filter should be installed with the open end seated inside the nut. The metal gasket may be reused if it is not damaged.
2. Using two wrenches, tighten outlet fitting to pump.
3. Using two wrenches again, tighten fuel line to outlet fitting. Remove clamp from hose.

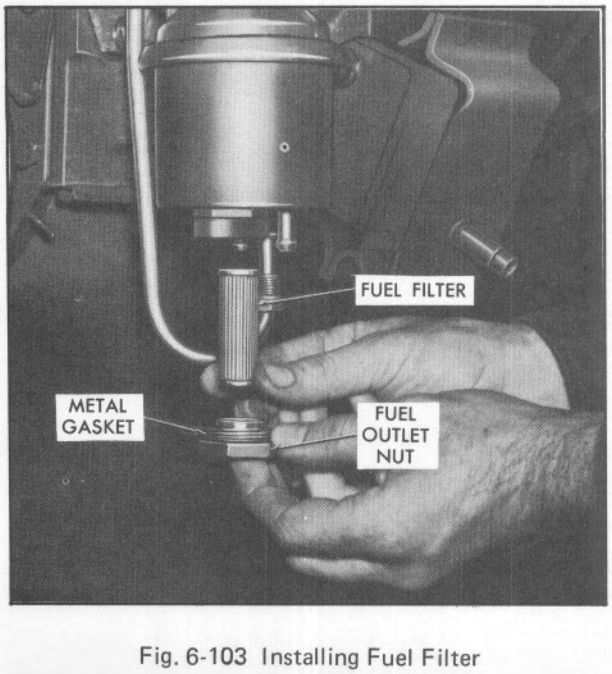


Fig. 6-103 Installing Fuel Filter

4. Wipe all gasoline that may have spilled and ventilate area before starting engine.

5. Start engine and check for leaks; correct leaks as necessary.

82. Fuel Pump

a. Removal

1. Raise Car.

2. Disconnect fuel line from tank (fuel pump inlet) at fuel pump and plug line. Hold a cloth around pump connections to absorb any fuel that leaks out.

3. Remove vapor return hose from fitting on fuel pump and plug hose.

4. Disconnect fuel-pump-to-carburetor line (fuel pump outlet) and position out of way.

5. Remove mounting screws from upper and lower flanges.

6. Tipping pump upward, pull pump straight outward and remove from car.

b. Installation

1. Clean mounting flange and place a new gasket in position. Use cement to hold gasket in position.

2. Crank engine until fuel pump eccentric is at low point of contact with fuel pump arm.

3. Position pump on engine. Loosely install two washer head screws.

4. With mounting screws loose, lift up on pump. Tighten screws to 13 foot-pounds.

5. Connect fuel line from carburetor to outlet fitting on pump and tighten securely.

6. Unplug fuel line from fuel tank, attach line to pump inlet and secure with clamp.

7. Install vapor return hose on fitting in fuel pump and secure with clamp.

8. Lower car and run engine to check for leaks in the pump area.

QUADRAJET CARBURETOR ADJUSTMENT SPECIFICATIONS MODEL 4MV

Federal Vehicles*

Throttle Bore	
Primary	1-3/8"
Secondary	2-1/4"
Main Venturi	
Primary	1.093"
Secondary	.625"
Teritiary	.281"
Air Valve Dashpot Adjustment	.030"
Air Valve Lockout Adjustment	.015"
Secondary Metering Rod Hanger	
Service Hanger Only	.840"
Secondary Throttle Closing Adjustment	.020"
Air Valve Spring Windup Adjustment	
Except Altitude	1/2 turn
Eldorado Altitude	9/16 turn
Altitude Except Eldorado	7/16 turn
Commercial Vehicles	3/8 turn
Choke Rod Adjustment	.110"
(Setting)	Index
Vacuum Break Adjustment	
All Except Eldorado (3/16")	.185"
Eldorado	.200"
Float Level Adjustment	
Except Eldorado 1/4"	.250"
Eldorado Only 23/64	.360"
Pump Rod Adjustment (1/4")	.250"
Inner Hole capacity 11.0 to 14.0 cc per 10 strokes	
Unloader Adjustment (5/16")	.312"
Fast Idle Setting - RPM	
(A/C off) Second step of cam	1200 - 1250
Curb Idle - RPM (In drive, A/C off)	600
Low Speed Idle - RPM (In drive, A/C off)	400

* All vehicles not equipped for sale in the state of California, except the commercial chassis, are called "Federal Vehicles". The commercial chassis can be sold in California as well as the remaining states.

METERING SPECIFICATIONS

For All Series Except Eldorado and Commercial #7044230 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.049
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.055
Side Idle Bleeds	0.049
Metering Rods Identification	41B
Metering Rods Economy End	0.041
Metering Rods Power End	0.026
Metering Jets	(0.068) 68C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.032
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	3/8

For Eldorado Series #7044232 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.054
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.050
Side Idle Bleeds	0.049
Metering Rods Identification	45B
Metering Rods Economy End	0.045
Metering Rods Power End	0.026
Metering Jets	(0.069) 69C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.030
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	1/2

QUADRAJET CARBURETOR ADJUSTMENT SPECIFICATIONS
MODEL 4MV
California Vehicles

Throttle Bore	
Primary	1-3/8"
Secondary	2-1/4"
Main Venturi	
Primary	1.093"
Secondary	.625"
Teritiary	.281"
Air Valve Dashpot Adjustment	.030"
Air Valve Lockout Adjustment	.015"
Secondary Metering Rod Hanger Service Hanger Only	.840"
Secondary Throttle Closing Adjustment	.020"
Air Valve Spring Windup Adjustment	
All Except Eldorado	3/8 turn
Eldorado	1/2 turn
Choke Rod Adjustment	.110"
(Setting)	Index
Vacuum Break Adjustment	
All Except Eldorado (3/16")	.185"
Eldorado	.200"
Float Level Adjustment	
Except Eldorado 1/4"	.250"
Eldorado Only 23/64	.360"
Pump Rod Adjustment (1/4")	.250"
Inner hole capacity 11.0 to 14.0 cc per 10 strokes	
Unloader Adjustment (5/16")	.312"
Fast Idle Setting - RPM	
(A/C off) second step of cam	1200-1250
Curb Idle - RPM (In drive, A/C off)	600
Low Speed Idle - RPM (In drive, A/C off)	400

METERING SPECIFICATIONS

For All Series Except Eldorado and Commercial #7044530 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.050
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.055
Side Idle Bleeds	0.049
Metering Rods Identification	41B
Metering Rods Economy End	0.041
Metering Rods Power End	0.026
Metering Jets	(0.068) 68C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.032
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	3/8

For Eldorado Series #7044532 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.054
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.050
Side Idle Bleeds	0.049
Metering Rods Identification	45B
Metering Rods Economy End	0.045
Metering Rods Power End	0.026
Metering Jets	(0.069) 69C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.030
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	1/2

QUADRAJET CARBURETOR ADJUSTMENT SPECIFICATIONS MODEL 4MV

Altitude Vehicles (4,000 Ft. and Above)

Throttle Bore	
Primary	1-3/8″
Secondary	2-1/4″
Main Venturi	
Primary	.093″
Secondary	.625″
Teritiary	.281″
Air Valve Dashpot Adjustment	.030″
Air Valve Lockout Adjustment	.015″
Secondary Metering Rod Hanger	
Service Hanger Only	.840″
Secondary Throttle Closing Adjustment	.020″
Air Valve Spring Windup Adjustment	
All Except Eldorado	7/16 turn
Eldorado	9/16 turn
Choke Rod Adjustment	.110″
(Setting)	Index
Vacuum Break Adjustment	
All Except Eldorado (3/16″)	.185″
Eldorado	.200″
Float Level Adjustment	
Except Eldorado 1/4″	.250″
Eldorado Only 23/64	.360″
Pump Rod Adjustment (11/32″)	.344″
Inner hole capacity 7.0 to 10.0 cc per 10 strokes	
Unloader Adjustment (5/16″)	.312″
Fast Idle Setting - RPM (A/C off) second step of cam	1200-1250
Curb Idle - RPM (In drive, A/C off)	600
Low Speed Idle - RPM (In drive, A/C off)	400

METERING SPECIFICATIONS

For All Series Except Eldorado and Commercial #7044234 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.051
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.055
Side Idle Bleeds	0.049
Metering Rods Identification	38B
Metering Rods Economy End	0.038
Metering Rods Power End	0.026
Metering Jets	(0.066) 66C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.036
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	7/16

For Eldorado Series #7044235 or Equivalent

Primary Side	Inch
Idle Tubes	0.036
Channel Restrictions	0.054
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.050
Top Well Bleeds	0.050
Side Idle Bleeds	0.049
Metering Rods Identification	39B
Metering Rods Economy End	0.039
Metering Rods Power End	0.026
Metering Jets	(0.067) 67C
Idle Mixture Screws	(Approx) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	0.034
Secondary Side	
Secondary Well Tubes	0.036
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	9/16

QUADRAJET CARBURETOR ADJUSTMENT SPECIFICATIONS MODEL 4MV

Commercial Vehicles

Throttle Bore	
Primary	1-3/8"
Secondary	2-1/4"
Main Venturi	
Primary	.093"
Secondary	.625"
Teritiary	.281"
Air Valve Dashpot Adjustment	.030"
Air Valve Lockout Adjustment	.015"
Secondary Metering Rod Hanger	
Service Hanger Only	.840"
Secondary Throttle Closing Adjustment	.020"
Air Valve Spring Windup Adjustment	3/8 turn
Choke Rod Adjustment	.110"
(Setting)	Index
Vacuum Break Adjustment (3/16")	.185"
Float Level Adjustment	
Commercial 19/64	.290"
Pump Rod Adjustment (11/32")	.344"
Outer Hole capacity 7.0 to 10.0 cc per 10 strokes	
Unloader Adjustment (5/16")	.312"
Fast Idle Setting - RPM	
(A/C off) second step of cam	1200-1250
Curb Idle - RPM (In drive, A/C off)	600
Low Speed Idle - RPM (In drive, A/C off)	400

METERING SPECIFICATIONS

For Commercial Series #7044233 or Equivalent

	Inch
Primary Side	
Idle Tubes	0.036
Channel Restrictions	0.052
Auxiliary Well Bleeds	0.030
Side Well Bleeds	0.049
Top Well Bleeds	0.055
Side Idle Bleeds	0.050
Metering Rods Identification	36B
Metering Rods Economy End	0.036
Metering Rods Power End	0.026
Metering Jets	(0.066) 66C
Idle Mixture Screws	(Approx.) 2-1/4 turns
Accelerating Pump Jets	0.026
Pull Over Enrichment–Discharge	None
Secondary Side	
Secondary Well Tubes	0.032
Secondary Rods Identification	DG
Secondary Rod Wide Open Throttle Step	0.034
Accelerating Well Feed Holes	0.040
Accelerating Well Discharge Holes	0.055
Air Valve Wind Up	3/8

CARBURETOR NUMBER	APPLICATION	SERIES
7044230 or Equivalent	Federal* Vehicles	All Series Except Eldorado, Commercial, Altitude and California
7044232 or Equivalent	Federal* Vehicles	All Eldorados Except Altitude and California
7044233 or Equivalent	Commercial Vehicles	Commercial Vehicles Only
7044234 or Equivalent	Altitude Vehicles 4,000 Ft. and Above	Altitude Option All Series Except Eldorado, Commercial and California
7044235 or Equivalent	Altitude Vehicles 4,000 Ft. and Above	Altitude Option All Eldorados Except California
7044530 or Equivalent	California Vehicles	All Series Except Federal, Eldorado, Altitude and Commercial
7044532 or Equivalent	California Vehicles	All Eldorados Except Federal and Altitude

*All vehicles not equipped for sale in the State of California, except the Commercial Chassis, are called "Federal Vehicles." The Commercial Chassis can be sold in California as well as the remaining states.

FUEL PUMP SPECIFICATIONS

NOTE: Testing to be done with entire car at room temperature.

Fuel pressure at idle speed .... 5-1/4 to 6-1/2 psi
Fuel pump discharge per stroke at cranking speed .... 28 cc. Minimum
Fuel pump discharge in 17 strokes at cranking speed .... 1 pint Minimum

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Torque
260-M	Carburetor to Intake Manifold Screw (Rear)	5/16-18	15 ft. lbs.
260-M	Carburetor to Intake Manifold Screw (Front)	5/16-18	11 ft. lbs.
280-M	Fuel Pump to Cylinder Block Screw	5/16-18	13 ft. lbs.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

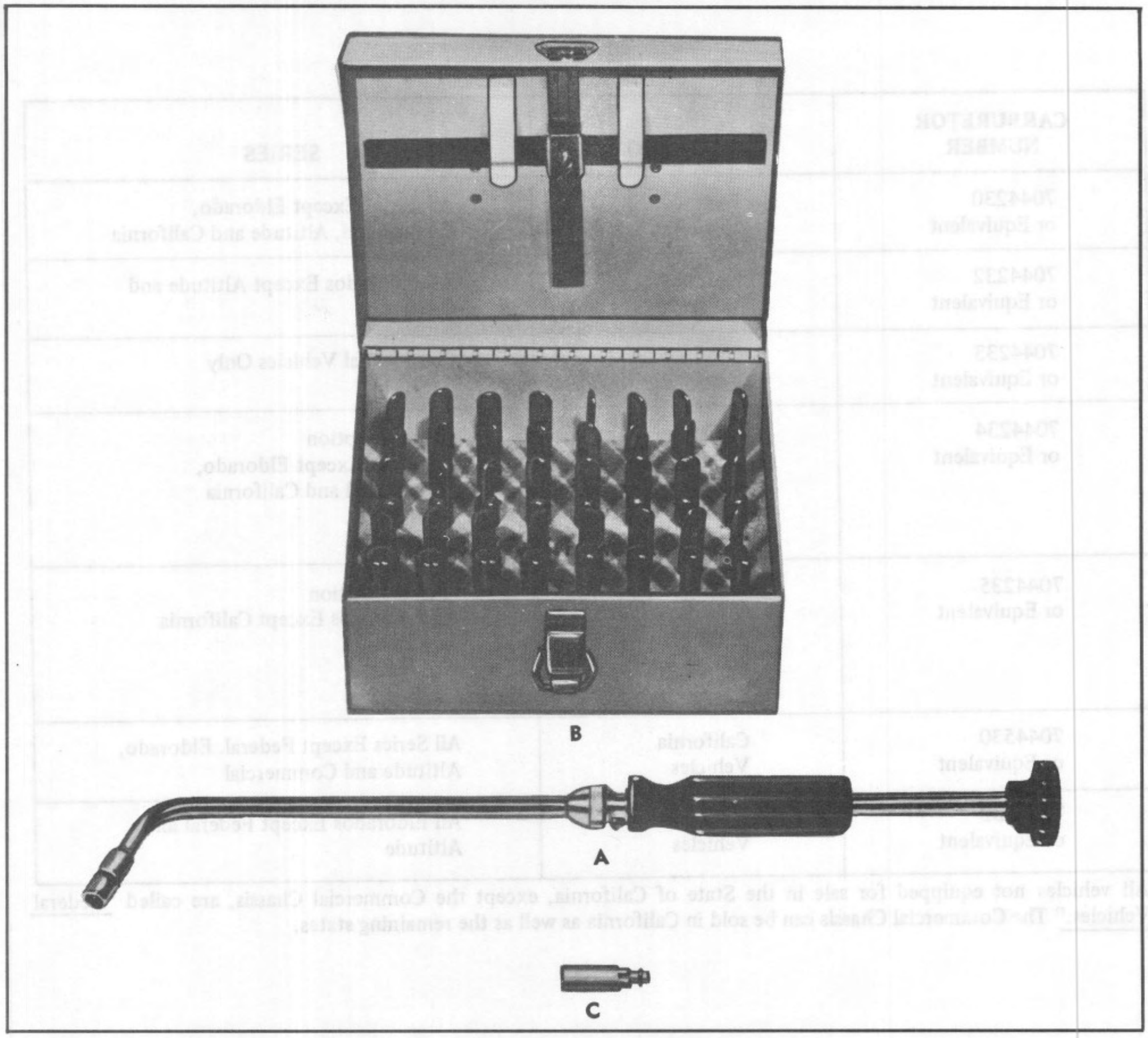


Fig. 6-104 Special Tools

Key	Tool Number	Name
A	J-22646	1/4" Hex-Head Extension Driver
B	J-9789-01	Universal Gage Set
C	J-22769	Seat Remover

CADILLAC EMISSION CONTROLS

All cars are equipped with various systems to control the emission of pollutants to the atmosphere. A positive crankcase ventilation (P.C.V.) system is used to prevent the emission of crankcase vapors. The air injection reactor (A.I.R.) system works to control the concentration of emission of exhaust pollutants. The exhaust gas recirculation system (E.G.R.) is used to reduce oxides of nitrogen emissions from the engine exhaust. An evaporative control system (E.C.S.) is also used to retain the fuel vapors normally lost due to evaporation in the fuel system.

Operating principles and service procedures for these systems are contained in this section.

POSITIVE CRANKCASE VENTILATION SYSTEM (P.C.V.)

The crankcase ventilation system, Fig. 6-105, is designed to prevent contaminating hydrocarbons from escaping to the atmosphere. This is accomplished by routing the vapors from the crankcase through a vacuum controlled ventilating valve on the right rocker arm cover into the intake manifold, where they mix with the air-fuel mixture and are burned in the combustion process.

Air is supplied to the crankcase ventilation system through a crankcase ventilating breather assembly located between the air cleaner and the left rocker arm cover.

The two critical points in this system are the ventilator (PCV) valve, which should be changed every 24,000 miles or 24 months, whichever occurs first, and the crankcase ventilating breather, located on the left rocker arm cover, which should be cleaned every 6,000 miles or four months, whichever occurs first. Other components of the system should be inspected, cleaned and/or replaced as necessary every 24,000 miles or 24 months, whichever occurs first.

When the engine is operating, air enters the positive crankcase ventilation system through the air cleaner and breather located on the left rocker arm cover. The breather contains the filtering element. The air then flows into the left rocker arm cover and into the valve lifter compartment, and combines with the blow-by gas, and unburned air-fuel mixture. These fumes are drawn

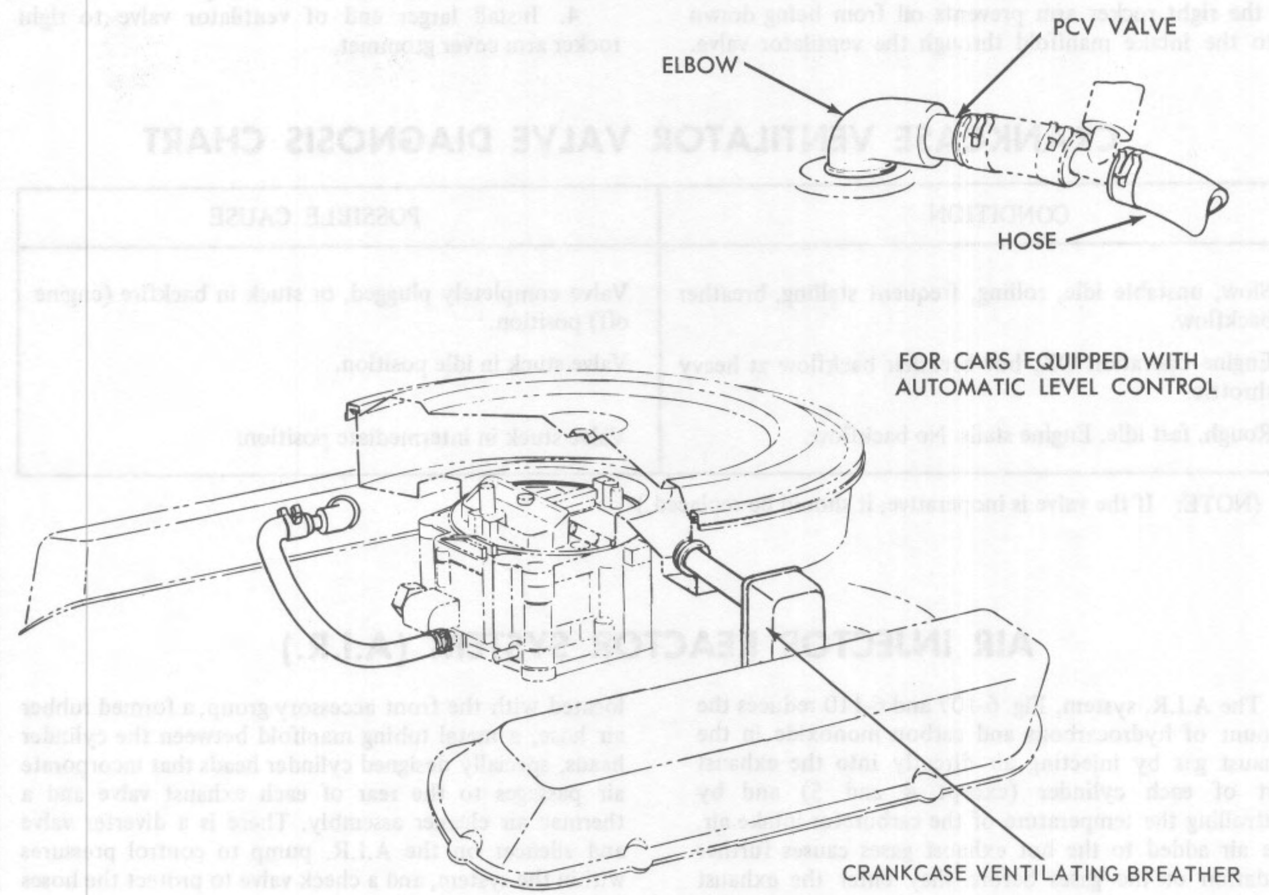


Fig. 6-105 Positive Crankcase Ventilation System

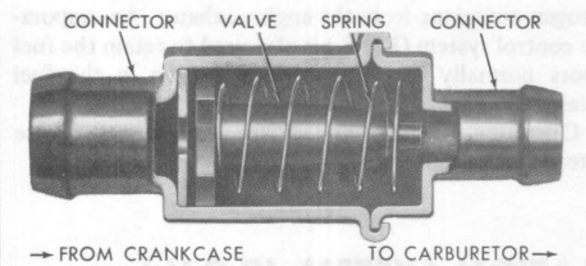


Fig. 6-106 P.C.V. Valve

through the right rocker arm cover and ventilation valve into the base of the carburetor and intake manifold, where they are mixed with the air-fuel mixture and burned.

The ventilator valve, Fig. 6-106, is constructed so that it is held closed by spring pressure when the engine is not running. This prevents an accumulation of hydrocarbon laden fumes from collecting in the intake manifold, which could result in hard starting.

As the engine is started, manifold vacuum pulls the valve open against the spring pressure and as long as there is engine vacuum, the valve floats, permitting crankcase fumes to enter the intake manifold. A baffle in the right rocker arm prevents oil from being drawn into the intake manifold through the ventilator valve.

In the event of an engine backfire through the intake manifold the ventilator valve shuts, preventing any flow through it. This action prevents the ignition of fumes in the crankcase.

During certain engine operations where more blow-by is created than the ventilator valve can handle, the excess amount is returned to the air cleaner and to the carburetor by way of the left rocker arm cover and breather assembly and burned in the engine, instead of being released into the atmosphere. The breather assembly acts as a separator to keep oil from being drawn into the air cleaner during this operation.

83. Positive Crankcase Ventilator Valve Replacement (Fig. 6-106)

a. Removal

1. Disconnect valve from rubber elbow on right rocker arm cover.
2. Release hose clamp and hose from ventilator valve grommet.

b. Installation

1. Place a small amount of silicone on both ends of new ventilator valve.
2. Install new valve with smaller end into hose.
3. Secure hose to valve with clamp.
4. Install larger end of ventilator valve to right rocker arm cover grommet.

CRANKCASE VENTILATOR VALVE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE
Slow, unstable idle, rolling, frequent stalling, breather backflow.	Valve completely plugged, or stuck in backfire (engine off) position.
Engine operation OK, but breather backflow at heavy throttle.	Valve stuck in idle position.
Rough, fast idle. Engine stalls. No backflow.	Valve stuck in intermediate position.

(NOTE: If the valve is inoperative, it should be replaced.)

AIR INJECTOR REACTOR SYSTEM (A.I.R.)

The A.I.R. system, Fig. 6-107 and 6-110 reduces the amount of hydrocarbons and carbon monoxide in the exhaust gas by injecting air directly into the exhaust port of each cylinder (except 4 and 5) and by controlling the temperature of the carburetor intake air. The air added to the hot exhaust gases causes further oxidation of the gases before they enter the exhaust manifold. By regulating the inlet air temperature, the carburetor is calibrated to reduce exhaust emissions.

The A.I.R. system consists of a belt-driven pump located with the front accessory group, a formed rubber air hose, a metal tubing manifold between the cylinder heads, specially designed cylinder heads that incorporate air passages to the rear of each exhaust valve and a thermac air cleaner assembly. There is a diverter valve and silencer on the A.I.R. pump to control pressures within the system, and a check valve to protect the hoses and pump from hot gases.

Do not attempt to operate vehicle with drive belt disconnected.

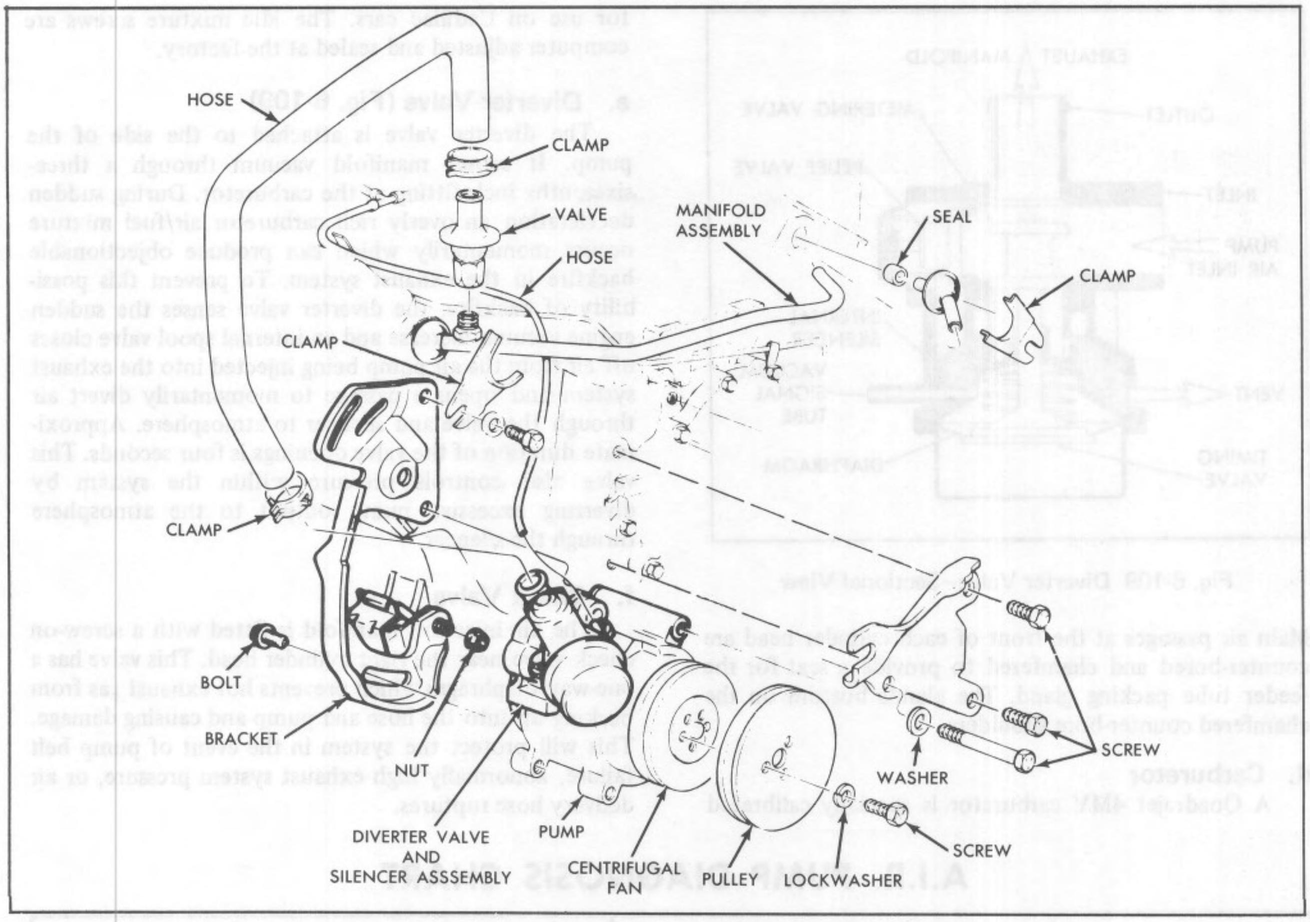


Fig. 6-107 Air Injection Reactor System

a. Air Pump (Fig. 6-108)

The belt-driven air pump is located at the lower right front of the engine. The pump front mounting bracket is attached to the front of the engine. The pump rear mounting bracket is attached to the cylinder block. Power take-off for the pump is at the crankshaft pulley. Pump speed is 1.20 times crankshaft speed. Intake air passes through a centrifugal fan at the front of the pump, where foreign materials are separated from the air by centrifugal force. Air is delivered to the air injection manifold by a formed flexible hose of three-quarter inch inside diameter fitted to a three-quarter inch exhaust tube on the diverter valve at the side of the pump, hoses are secured to all fittings by clamps.

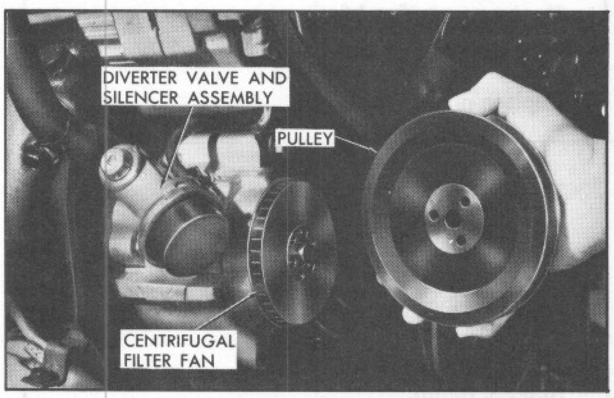


Fig. 6-108 A.I.R. Pump

The only serviceable component of this pump is the centrifugal fan. Do not assume pump is defective if it squeaks when turned by hand. Do not lubricate the pump in any way.

(NOTE: If the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the centrifugal filter fan should be masked off to prevent liquids from entering the pump.)

b. Air Injection Manifold

The air injection manifold is held in the cylinder heads by clamps. These clamps must be installed correctly to insure proper sealing. The right hand side clip, (generator side) should be installed with the flanges pointing away from the cylinder head. The left hand clip should be installed with the flange pointing towards the cylinder head. Each feeder tube of the manifold is sealed by an asbestos and graphite packing gland seal which fits on the tube below the flange.

c. Cylinder Heads

Each cylinder head contains an air passage inboard of the valves with connecting passages at each exhaust valve area (except cylinders 4 and 5). The passages lead into the exhaust passages directly behind the valves.

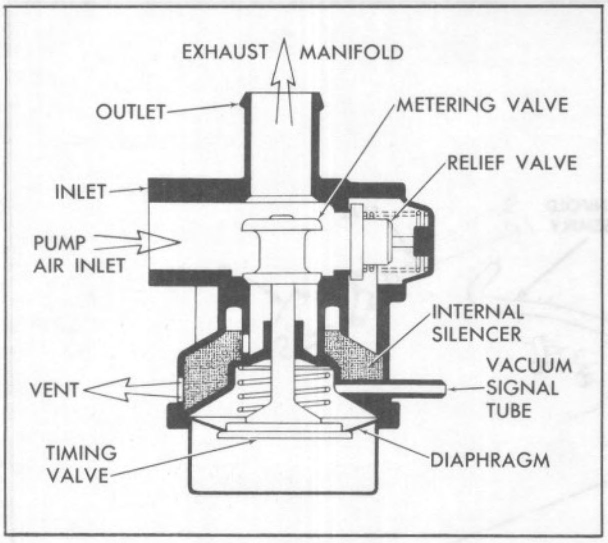


Fig. 6-109 Diverter Valve—Sectional View

Main air passages at the front of each cylinder head are counter-bored and chamfered to provide a seat for the feeder tube packing gland. The glands bottom on the chamfered counter-bore shoulders.

d. Carburetor

A Quadrajet 4MV carburetor is specially calibrated for use on Cadillac cars. The idle mixture screws are computer adjusted and sealed at the factory.

e. Diverter Valve (Fig. 6-109)

The diverter valve is attached to the side of the pump. It senses manifold vacuum through a three-sixteenths inch fitting at the carburetor. During sudden deceleration an overly rich carburetor air/fuel mixture occurs momentarily which can produce objectionable backfire in the exhaust system. To prevent this possibility of backfire, the diverter valve senses the sudden engine vacuum increase and an internal spool valve closes off air from the air pump being injected into the exhaust system and opens a passage to momentarily divert air through the valve and silencer to atmosphere. Approximate duration of the valve openings is four seconds. This valve also controls pressure within the system by diverting excessive pump output to the atmosphere through the silencer.

f. Check Valve

The air injection manifold is fitted with a screw-on check valve near the right cylinder head. This valve has a one-way diaphragm which prevents hot exhaust gas from backing up into the hose and pump and causing damage. This will protect the system in the event of pump belt failure, abnormally high exhaust system pressure, or air delivery hose ruptures.

A.I.R. PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive Belt Noise	Loose belt.	Tighten belt.
	Seized pump.	Replace pump.
Excessive Pump Noise, Chirping, Rumbling or Knocking	Leak in hose.	Locate source of leak and correct.
	Loose hose.	Reassemble and replace or tighten hose clamp.
	Hose touching other engine parts.	Adjust hose position.
	Diverter valve failure.	Replace valve.
	Check valve failure.	Replace valve.
	Pump mounting fasteners loose.	Retorque all mounting screws.
	Centrifugal fan damaged.	Replace centrifugal fan.
	Pump failure.	Replace pump.
	Cup plug missing from cover.	Replace plug.
No air supply.	Loose belt.	Tighten belt.
	Leak in hose.	Locate source of leak and correct.
	Leak at hose fitting.	Reassembly and replace or tighten hose clamps.
	Diverter valve failure.	Replace valve.
	Check valve failure.	Replace valve.
	Pump failure.	Replace pump.

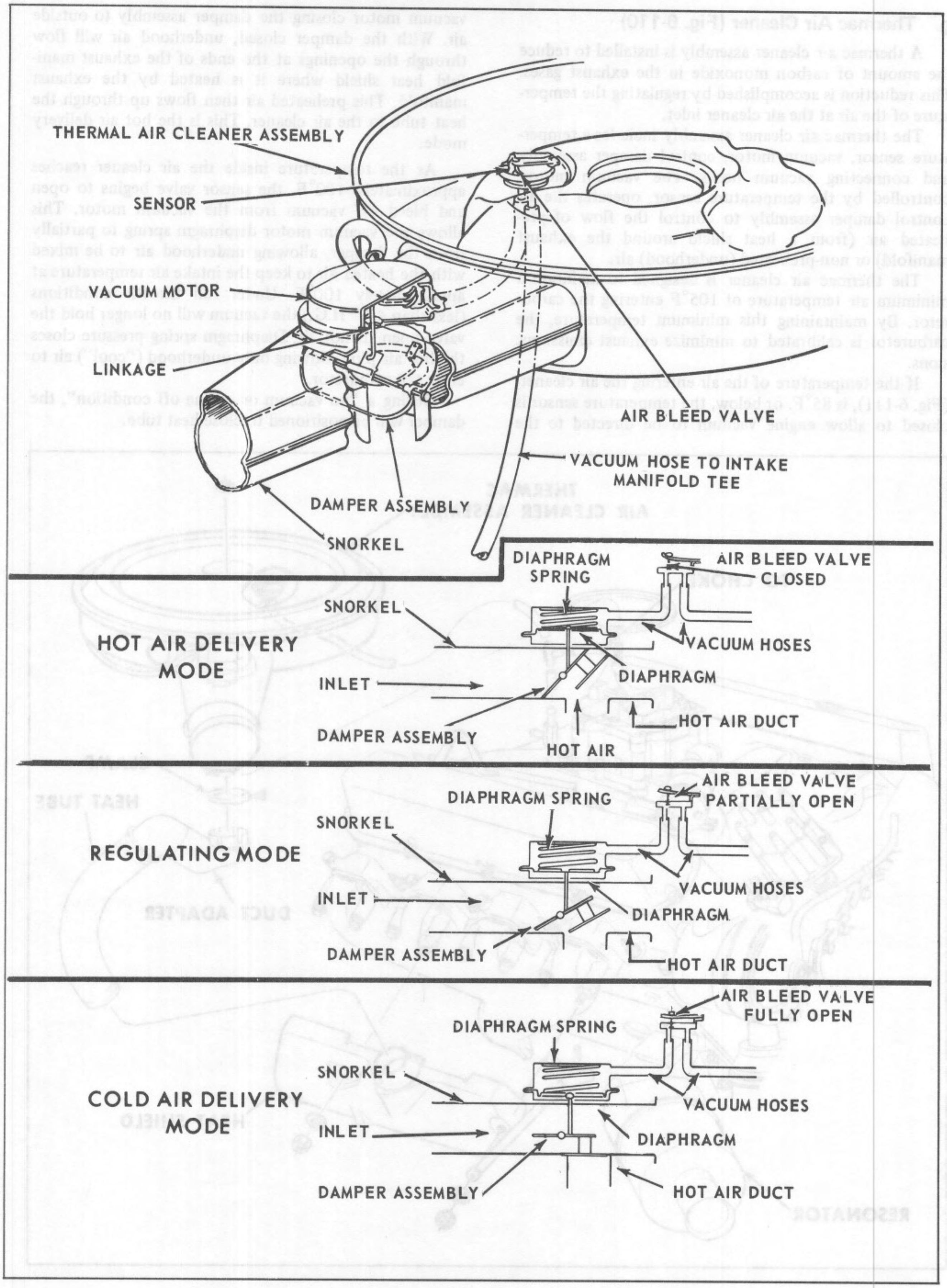


Fig. 6-111 Thermac Air Cleaner Operation

84. Testing Thermac Air Cleaner

1. Check heat tube and vacuum hoses for condition and secure connections. Repair or replace as required before further testing.

2. With engine off, remove air cleaner cover and tape Thermometer, J-5421, to air cleaner base next to sensor.

3. Allow a short time for thermometer reading to stabilize. Read thermometer and proceed on following basis: If temperature is below 80°F, continue with step 4. If temperature is above 80°F, remove air cleaner and allow it to cool to approximately 75°F.

4. Install a vacuum gage in the vacuum line between sensor and vacuum motor.

5. Check position of control damper by looking in end of snorkel. Damper should be open.

6. Install cover on air cleaner without nut and start engine.

7. If ambient temperature is above 85°F, proceed to step 10.

8. If ambient temperature is below 85°F, observe position of damper in snorkel. When damper begins to move toward the open (outside air) position, immediately remove air cleaner cover and record temperature and vacuum readings.

9. Replace air cleaner cover and continue watching damper.

10. If ambient temperature has risen above 85°F, it is only necessary to make sure damper is completely open by 105°F. When damper moves to full open position, again remove air cleaner cover and record temperature and vacuum readings.

11. Compare readings obtained in steps 8 and 10 with following chart:

Damper Position	Temperature Reading, °F	Vacuum Reading in Hg.
Starts to Open	85°	Full
Full Open	105°	4"-6"

12. Replacement of thermac air cleaner components should be based on following information.

a. If temperature is within specifications, thermac air cleaner is functioning properly.

b. If temperature is out of specification, but vacuum is correct, replace sensor as described in Note 88.

c. If damper does not open at correct temperature, proceed to Step 13.

13. With engine at idle speed, disconnect damper assembly vacuum hose at sensor unit. Damper door should move to open (outside air) position. If damper does not open, check linkage for a binding condition.

14. Reconnect damper assembly vacuum hose with engine at idle speed. With vacuum gage reading of at least 9 in. Hg. (connect to manifold vacuum fitting if sensor is open) damper door should close snorkel passage (hot air position). If damper does not close, there is a vacuum leak in the vacuum motor diaphragm. Replace vacuum motor as described in Note 90.

85. A.I.R. System Check Valve

a. Inspection

1. The check valve should be inspected whenever the hose is disconnected from the check valve or whenever check valve failure is suspected. (A pump that had become inoperative and had shown indications of having exhaust gases in the pump would indicate check valve failure.)

2. Blow through the check valve (toward the cylinder head) then attempt to suck back through check valve. Flow should only be in one direction (toward the air manifold).

b. Removal

1. Release clamp and disconnect air hose from check valve.

2. Unscrew check valve from manifold fitting.

c. Installation

1. Screw check valve onto manifold fitting.

2. Position air hose on check valve and secure with clamp.

86. A.I.R. System Diverter Valve and Silencer Assembly (Fig. 6-107)

(NOTE: The silencer is staked to the diverter valve and cannot be removed. If a damaged silencer is encountered, the diverter valve and silencer assembly must be replaced.)

a. Inspection

1. Check condition and routing of all lines especially the signal line. All lines must be secure, without crimps and not leaking.

2. Disconnect signal line at valve. A vacuum signal must be available with engine running.

3. With engine stabilized at idle speed, no air should be escaping through the silencer. Manually open and quickly close the throttle, a momentary blast of air should discharge through silencer for at least one second.

4. Defective valves should be replaced.

b. Removal

1. Disconnect vacuum hose from diverter valve.

2. Release clamp and remove air hose from fitting on diverter valve.

3. Remove two screws securing diverter valve and silencer assembly to pump and remove diverter valve assembly.

4. Remove gasket material from diverter valve and pump flanges.

c. Installation

1. Position new gasket on pump flange.

2. Position diverter valve on pump flange and secure with two screws.

3. Connect air hose to diverter valve fitting and secure with clamp.

4. Connect vacuum hose to fitting on diverter valve.

87. A.I.R. Pump Centrifugal Filter Fan (Fig. 6-108)

The centrifugal filter fan should not be cleaned, either with compressed air or solvents.

CAUTION: Centrifugal fan should not be removed from pump unless it is damaged, as removal procedures will destroy impeller.

a. Removal

1. Remove pump drive belt.
2. Remove three screws and rewmove pump pulley, Fig. 6-108.
3. Break remaining portion of centrifugal fan off pump hub, being careful that fragments do not enter air intake hole.

b. Installation

1. Position new centrifugal fan on pump hub.
2. Position pump pulley against centrifugal fan.
3. Install three pulley screws and tighten equally to 60 inch-pounds. This will press centrifugal fan onto pump hub. Do not drive centrifugal fan on with hammer.

(NOTE: The slight amount of interference with the housing bore is normal. After a new fan has been installed, it may squeal upon initial operation or until its O.D. sealing lip has worn in. This may require a short period of pump operation at various engine speeds.)

4. Install pump drive belt.
5. Adjust drive belt tension as described in Note 10.

88. A.I.R. Pump

Servicing of this pump should be limited to replacement of the entire pump. Do not open pump for any reason. Do not clamp it in a vise or use a hammer or pry bar on the pump housing. If pry bar is used during belt tensioning, pry as close to rear of pump cover as possible.

a. Inspection

Accelerate engine to approximately 1500 RPM and observe air flow from hose. If air flow increases as engine is accelerated, pump is operating satisfactorily. If air flow does not increase or is not present, proceed as follows:

1. Check for proper drive belt tension.
2. Check for a leaky pressure relief valve. Air may be heard leaking with the pump running.

(NOTE: The A.I.R. System is not completely noiseless. Under normal conditions noise rises in pitch as engine speed increases. To determine if excessive noise is the fault of the Air Injection Reactor System, operate the engine with the pump drive belt removed. If excessive noise does not exist with the belt remove proceed as follows:)

3. Check for a seized Air Injection Pump.
4. Check hoses, tubes and all connections for leaks and proper routing.
5. Check air injection pump for proper mounting.
6. If none of the above conditions exist and the air injection pump has excessive noise remove and replace pump unit.

b. Removal

1. Raise car and place on jack stands.
2. Remove air hose from diverter valve.
3. Disconnect vacuum line from fitting on diverter valve.
4. Remove three screws securing pulley to pump and remove pulley and belt.
5. Remove mounting bolt at top of air pump.
6. Remove adjusting bolt from bottom rear of pump and remove pump and diverter valve as an assembly.

c. Installation

1. Lift pump up through space between lower radiator hose and oil filter. Rotate pump so that diverter valve passes over oil filter.
2. Position pump against mounting bracket and loosely install upper screw.
3. Loosely install adjusting bolt at lower rear of pump.
4. Install pulley and drive belt. Adjust drive belt as described in Note 10.
5. Tighten both mounting and adjusting screws to 25 foot-pounds.
6. Connect air hose to larger fitting of diverter valve and secure with clamp.
7. Install vacuum hose to small fitting on diverter valve.

89. Thermac Air Cleaner Temperature Sensor

a. Removal

1. Detach hose between sensor and manifold fitting and remove air cleaner from engine.
2. Remove hose between sensor and vacuum motor, Fig. 6-112.

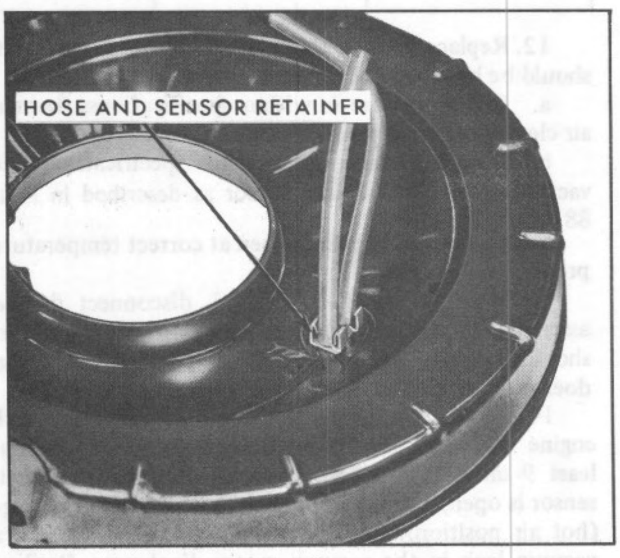


Fig. 6-112 Thermac Air Cleaner Sensor Hoses

3. Pry retainer away from sensor vacuum fittings and remove retainer.
4. Note position of sensor and remove sensor with gasket from position in air cleaner.

b. Installation

1. Install gasket on sensor and install sensor to air cleaner in original position, Fig. 6-113.
2. Press retainer on vacuum connections.
3. Connect vacuum hose between sensor and vacuum motor. Install vacuum hose to remaining fitting.
4. Install air cleaner, making sure heat tube engages heat shroud on exhaust manifold.
5. Connect vacuum hose between sensor and manifold fitting.

90. Thermac Air Cleaner Vacuum Motor

a. Removal

1. Disconnect hose between sensor and manifold fitting and remove air cleaner from engine.
2. Disconnect vacuum hose between motor and sensor.
3. Drill a 1/16" hole in the center of each spotweld holding vacuum motor to snorkel. Enlarge hole as necessary to remove retainer.
4. Remove retainer and lift motor slightly off air cleaner.
5. Twist motor to one side to disengage link from valve and remove motor.

b. Installation

1. Install link in valve and position motor on air cleaner snorkel.

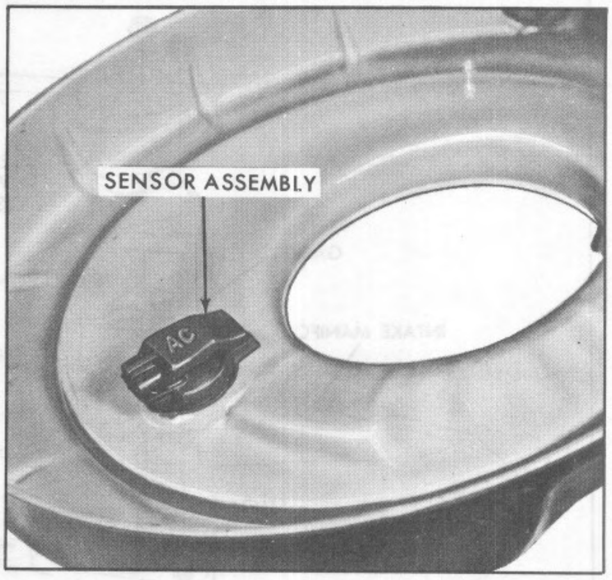


Fig. 6-113 Positioning Thermac Air Cleaner Sensor

2. Position retainer strap over motor and secure with two sheet metal screws.
3. Check operation of valve to see that screws do not interfere.
4. Connect vacuum hose between motor and sensor. Install vacuum hose on remaining fitting.
5. Install air cleaner, making sure heat tube engages heat shroud on exhaust manifold.
6. Connect vacuum hose between sensor and manifold fitting.

EXHAUST GAS RECIRCULATION (E.G.R.)

The Exhaust Gas Recirculation system (E.G.R.) is used on all engines to reduce oxides of nitrogen emissions in the engine exhaust.

During the combustion process nitrogen, which makes up 80 percent of the air, will tend to combine with oxygen at temperatures above 2500 degrees. During the combustion process, temperatures in the engines cylinders will go well above 2500 degrees which forms oxides of nitrogen.

To lower formation of nitrogen oxides, it is necessary to reduce combustion temperatures. This is done by introducing exhaust gases into the engine cylinders with the air fuel mixture for combustion.

The E.G.R. valve is mounted at the rear of the intake manifold, Fig. 6-114. Exhaust gas from the exhaust crossover is metered by the E.G.R. valve into an intake passage permitting flow into the cylinders.

Operation

The E.G.R. Valve, Fig. 6-115 is operated by ported vacuum. It is fully closed with vacuum less than 2 inches; it opens between 2 inches and 7" Hg; and is fully open with more than 7" Hg of vacuum. At idle and wide open throttle ported vacuum is low, the valve is closed and recirculation does not occur. At part throttle ported vacuum is high, the valve is open and exhaust gas recirculation is at maximum.

All engines use a temperature sensitive control valve in the vacuum signal line to the E.G.R. valve.

The valve is closed below 60°F engine metal temperature blocking vacuum to the E.G.R. valve giving better driveaway when the engine is cold.

The E.G.R. control valve is open above 60°F engine metal temperature allowing E.G.R. ported vacuum to be directed to the E.G.R. valve.

91. E.G.R. Valve Functional Check

1. Remove air cleaner assembly and plug manifold vacuum fitting.
2. Remove vacuum hose from distributor and plug.
3. Install tachometer.
4. Remove E.G.R. hose from E.G.R. valve and plug hose.
5. With A/C "Off", drive wheels blocked and transmission in park, start engine and bring to operating temperature. Put cam follower on second step of fast idle cam and note engine speed.
6. Attach a vacuum hose between the air cleaner vacuum port on the intake manifold and the E.G.R. valve or use external vacuum source of at least 5 inches.

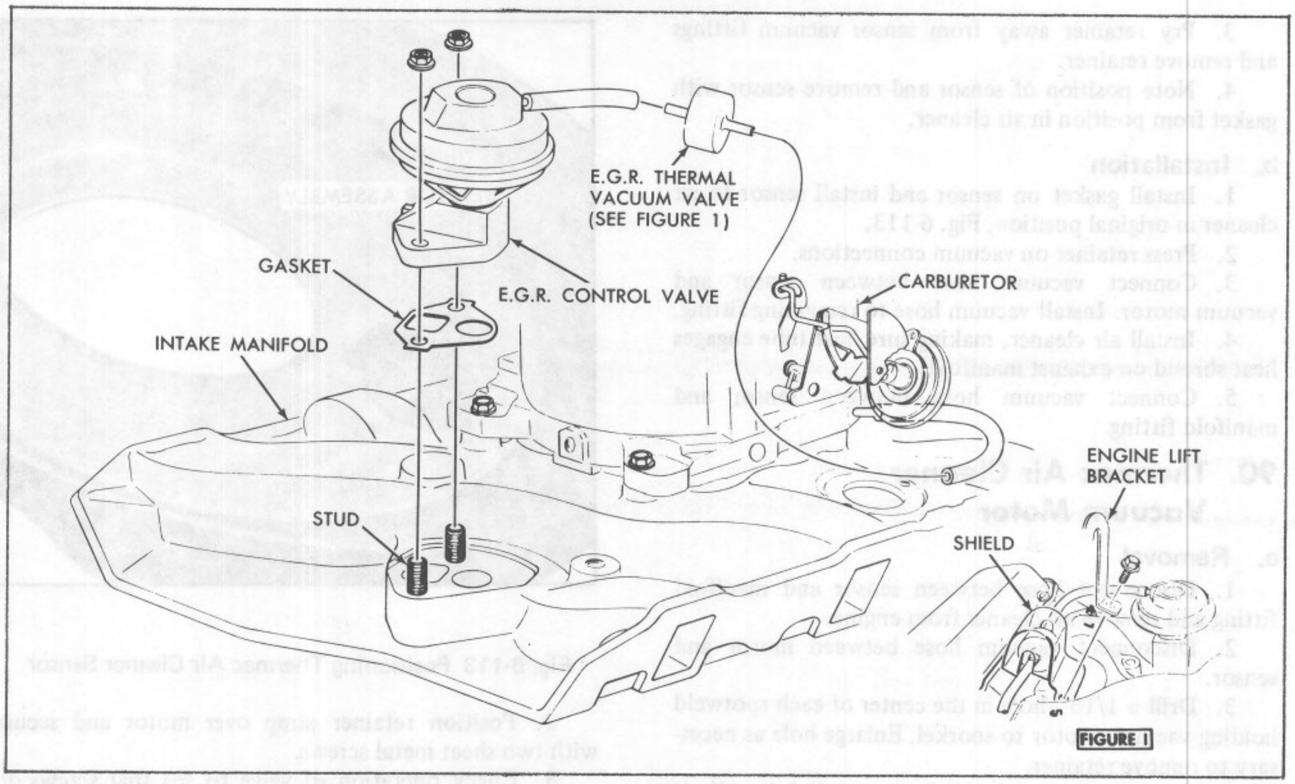


Fig. 6-114 E.G.R. Valve Mounting

Diaphragm should rise and engine speed should drop at least 250 R.P.M.

7. If engine speed does not drop as specified in Step 6, remove carburetor and clean the intake manifold E.G.R. ports and E.G.R. valve assembly as described in Notes 93 and 94. After cleaning, recheck function per Steps 5 and 6, if engine speed does not drop as specified, replace E.G.R. valve assembly.

8. Remove tachometer, connect distributor vacuum hose, E.G.R. vacuum hose and install air cleaner assembly.

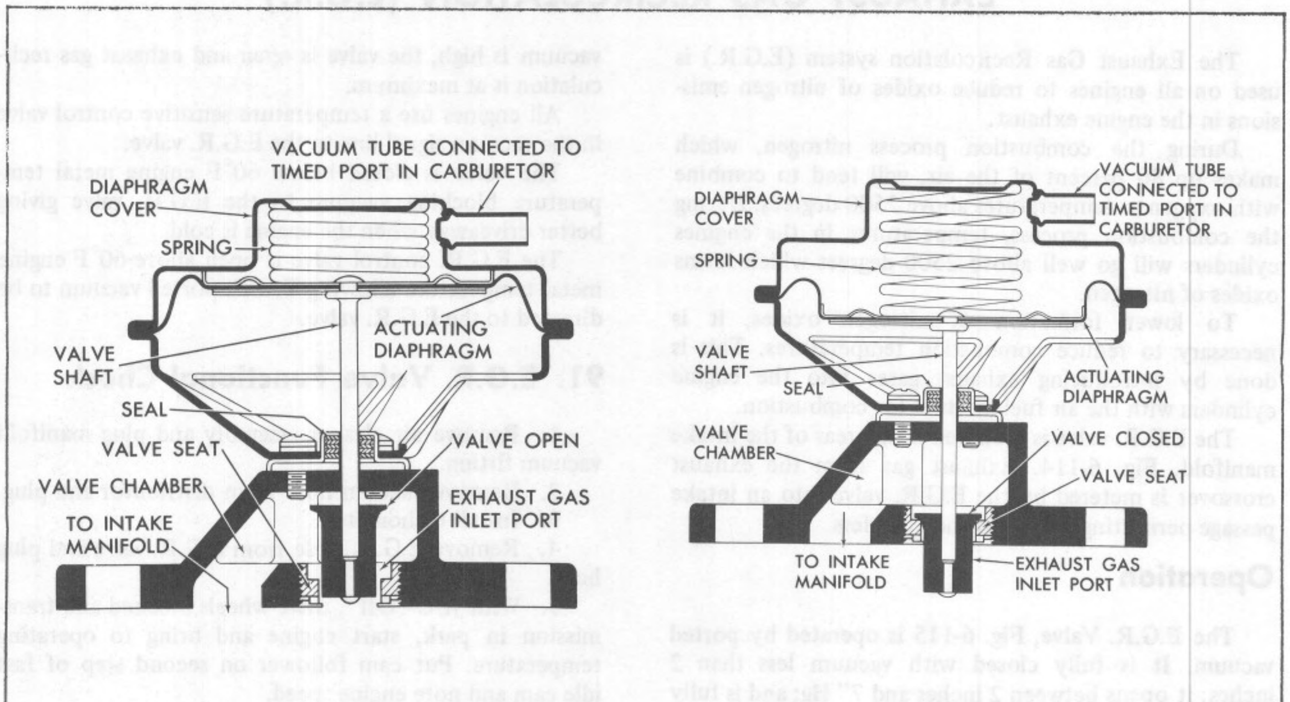


Fig. 6-115 E.G.R. Valve Operation

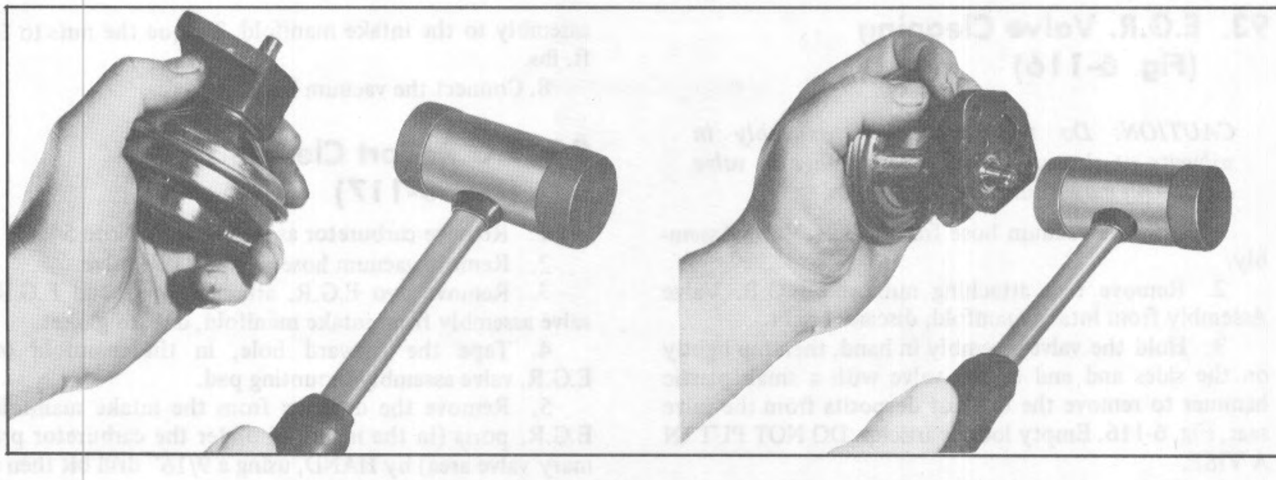


Fig. 6-116 Cleaning E.G.R. Valve

92. E.G.R. Control Valve Functional Check

The E.G.R. bi-metal valve is closed below 60°F engine metal temperature blocking vacuum to the E.G.R. valve giving better driveaway when the engine is cold.

The E.G.R. bi-metal valve is open above 60°F engine metal temperature allowing E.G.R. ported vacuum to be directed to the E.G.R. valve.

To check the operation of the valve it is necessary to lower its temperature below the 60°F change over point. This may be accomplished by exposing the valve to a cold air stream or by application of electronic circuit cooler to the exterior surfaces of the valve. Do not direct the cooling medium inside the valve. Check valve operation by applying oral vacuum to the valve at room temperature (above 60°F) and in its cooled (below 60°F) state. Valve should block air flow when cold and pass air when warm.

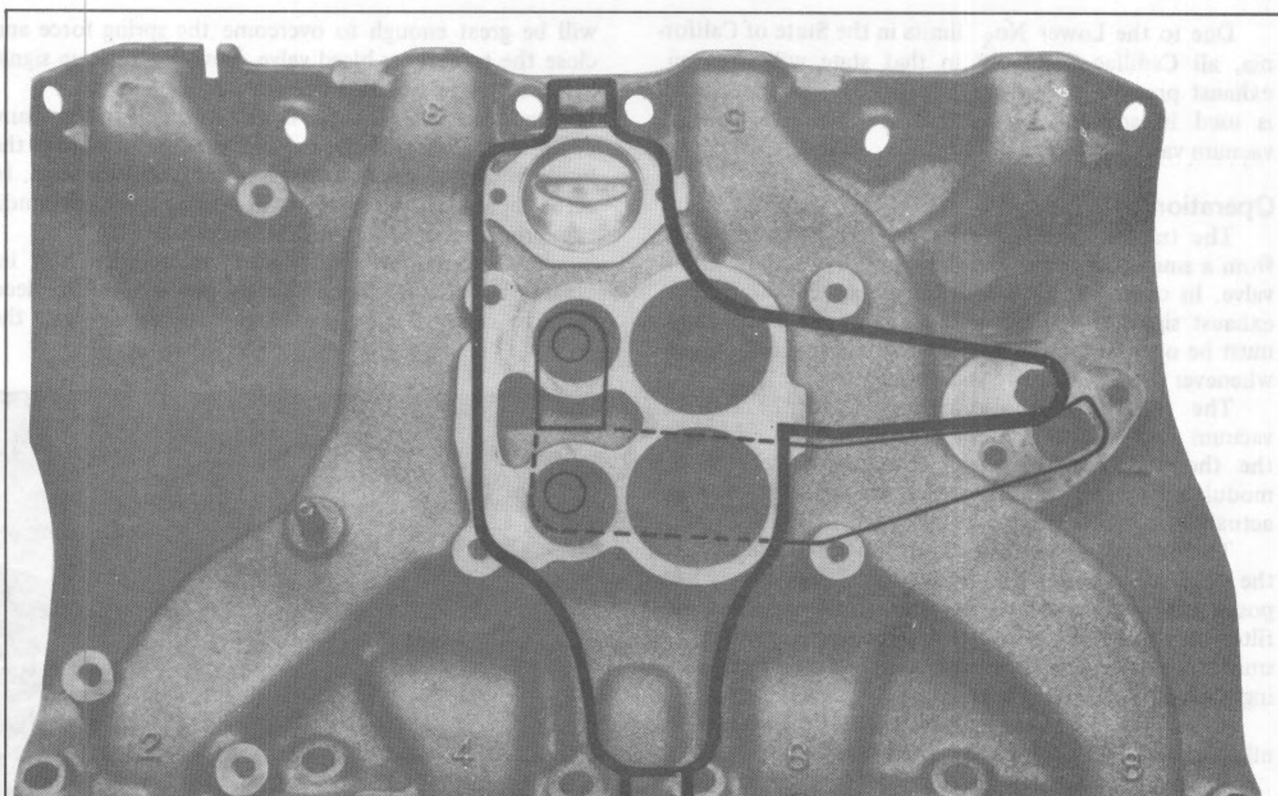


Fig. 6-117 E.G.R. Passages In Intake Manifold

93. E.G.R. Valve Cleaning (Fig. 6-116)

CAUTION: Do not wash valve assembly in solvents or degreaser permanent damage to valve diaphragm may result.

1. Remove vacuum hose from E.G.R. Valve Assembly.
2. Remove two attaching nuts and E.G.R. Valve Assembly from intake manifold, discard gasket.
3. Hold the valve assembly in hand, then tap lightly on the sides and end of the valve with a small plastic hammer to remove the exhaust desposits from the valve seat, Fig. 6-116. Empty loose particles. DO NOT PUT IN A VISE.
4. With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.
5. Depress the valve diaphragm and look at the valve seating area through the valve outlet for cleanliness. If valve or seat are not completely clean, repeat Step 3.
6. Look for remaining exhaust deposits in the valve outlet and seat area. Remove deposit build up with a screwdriver or other suitable sharp tool.
7. Clean mounting surfaces of intake manifold and valve assembly, then using a new gasket install the valve assembly to the intake manifold. Torque the nuts to 10 ft. lbs.
8. Connect the vacuum hose.

94. E.G.R. Port Cleaning (Fig. 6-117)

1. Remove carburetor as described in Note 54.
2. Remove vacuum hose from E.G.R. valve.
3. Remove two E.G.R. attaching nuts and E.G.R. valve assembly from intake manifold, discard gasket.
4. Tape the forward hole, in the manifold on E.G.R. valve assembly mounting pad.
5. Remove the deposits from the intake manifold E.G.R. ports (in the manifold under the carburetor primary valve area) by HAND, using a 9/16" drill bit then a screwdriver to clean the holes and chamfer. DO NOT USE AN ELECTRIC DRILL.
6. Brush any small particles down the two ports into the E.G.R. passage.
7. Plug the left E.G.R. port and using compressed air, blow through the right port.
8. Plug the right E.G.R. port and blow through the left E.G.R. port. Remove tape from E.G.R. valve assembly mounting surface.
9. Clean and install E.G.R. valve (see Note 93).
10. Install carburetor as described in Note 54.

EXHAUST PRESSURE TRANSDUCER

Due to the Lower No_x limits in the State of California, all Cadillac cars sold in that state will have an exhaust pressure transducer, Fig. 6-118. The transducer is used in addition to the E.G.R. valve and thermal vacuum valve.

Operation

The transducer receives its exhaust pressure signal from a small tube leading to the spacer under the E.G.R. valve. In order for the transducer to receive the proper exhaust signal, the holes in the end of the signal tube must be open and clear. Cleaning of this area is required whenever the E.G.R. valve is cleaned.

The transducer is also connected to the E.G.R. vacuum port in the carburetor throttle body (through the thermal vacuum valve). This source vacuum is modulated by the transducer and the resulting vacuum actuates the E.G.R. valve.

The exhaust signal is imposed on the bottom side of the transducer diaphragm while the upper side is exposed to atmospheric pressure through the slots and air filter on top of the housing. A light spring provides a small preload opposing the exhaust pressure signal holding the transducer valve open.

At idle the exhaust pressure is low and the vacuum is nil resulting in no E.G.R. valve operation.

At a slightly greater air flow, the vacuum source is equal to manifold vacuum, but the exhaust pressure is not sufficient to overcome the transducer spring force and the vacuum source is bled off leaving the E.G.R. valve closed.

At some still greater airflow, the exhaust pressure will be great enough to overcome the spring force and close the transducer bleed valve. Now, the vacuum signal is routed to the E.G.R. valve to force it open.

Once the E.G.R. valve opens, the exhaust pressure decreases because of the exhaust gases flowing into the intake manifold vacuum through the E.G.R. passage. In actual operation the system will reach a balanced condition providing optimum E.G.R. operation.

Any increase in engine load will momentarily increase the exhaust signal causing the transducer bleed valve to close allowing a stronger vacuum signal to the

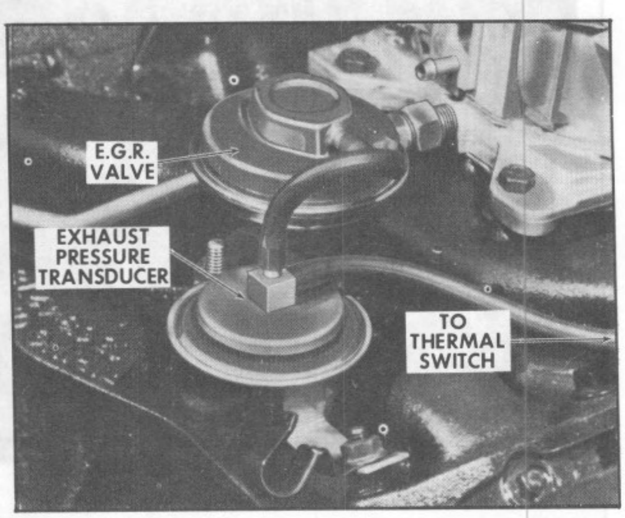


Fig. 6-118 Exhaust Pressure Transducer

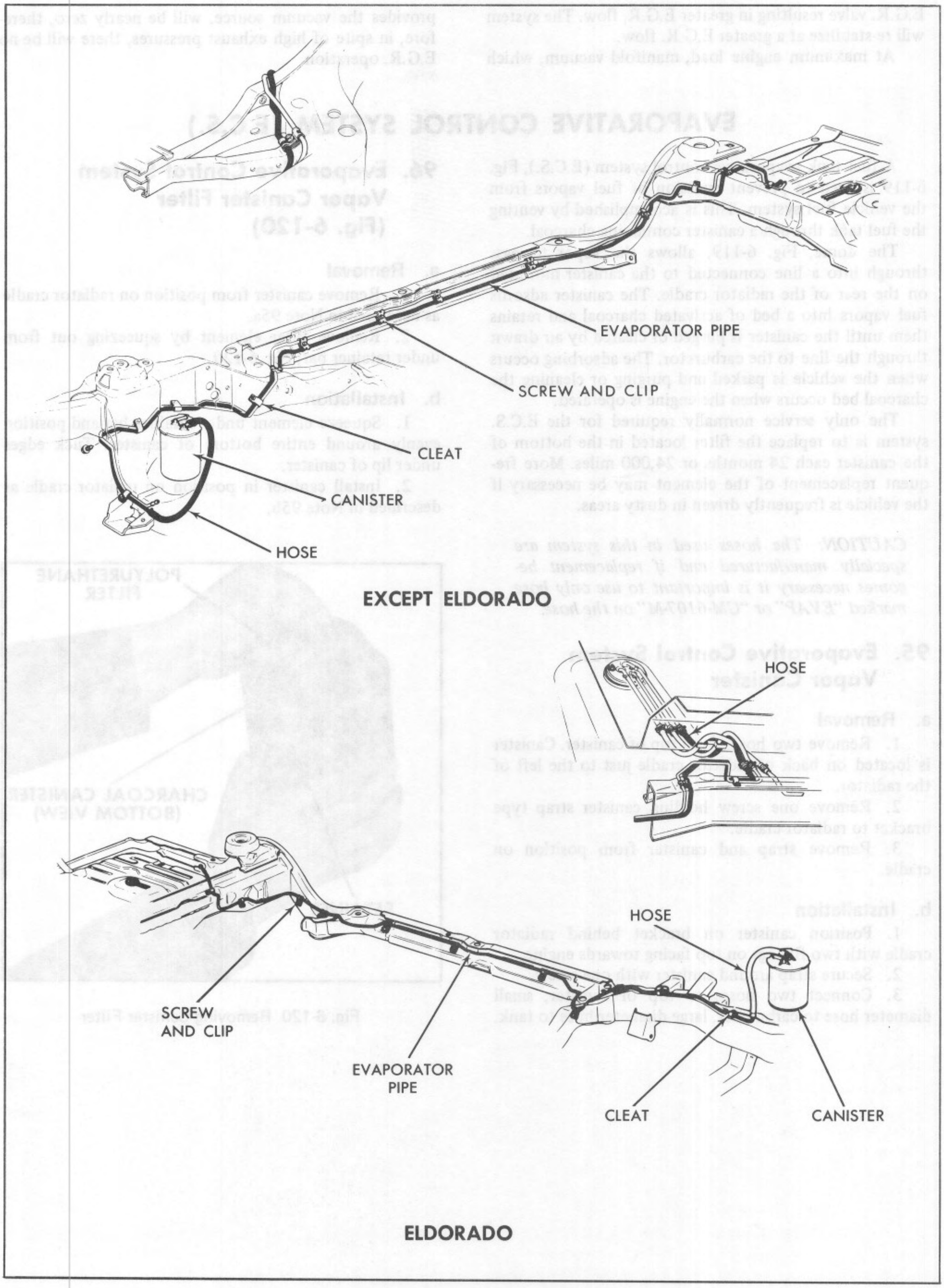


Fig. 6-119 Evaporative Control System

E.G.R. valve resulting in greater E.G.R. flow. The system will re-stabilize at a greater E.G.R. flow.

At maximum engine load, manifold vacuum, which provides the vacuum source, will be nearly zero, therefore, in spite of high exhaust pressures, there will be no E.G.R. operation.

EVAPORATIVE CONTROL SYSTEM (E.C.S.)

A fuel tank evaporative control system (E.C.S.), Fig. 6-119 is used to prevent emission of fuel vapors from the vehicle fuel system. This is accomplished by venting the fuel tank through a canister containing charcoal.

The dome, Fig. 6-119, allows the vapor to pass through into a line connected to the canister mounted on the rear of the radiator cradle. The canister adsorbs fuel vapors into a bed of activated charcoal and retains them until the canister is purged or cleared by air drawn through the line to the carburetor. The adsorbing occurs when the vehicle is parked and purging or cleaning the charcoal bed occurs when the engine is operated.

The only service normally required for the E.C.S. system is to replace the filter located in the bottom of the canister each 24 months or 24,000 miles. More frequent replacement of the element may be necessary if the vehicle is frequently driven in dusty areas.

CAUTION: The hoses used in this system are specially manufactured and if replacement becomes necessary it is important to use only hose marked "EVAP" or "GM-6107-M" on the hose.

95. Evaporative Control System Vapor Canister

a. Removal

1. Remove two hoses from top of canister. Canister is located on back of radiator cradle just to the left of the radiator.
2. Remove one screw holding canister strap type bracket to radiator cradle.
3. Remove strap and canister from position on cradle.

b. Installation

1. Position canister on bracket behind radiator cradle with two fittings on top facing towards engine.
2. Secure strap around canister with one screw.
3. Connect two hoses to top of canister; small diameter hose to carburetor, large diameter hose to tank.

96. Evaporative Control System Vapor Canister Filter (Fig. 6-120)

a. Removal

1. Remove canister from position on radiator cradle as described in Note 95a.
2. Remove filter element by squeezing out from under retainer bar, Fig. 6-120.

b. Installation

1. Squeeze element under retainer bar and position evenly around entire bottom of canister. Tuck edges under lip of canister.
2. Install canister in position on radiator cradle as described in Note 95b.

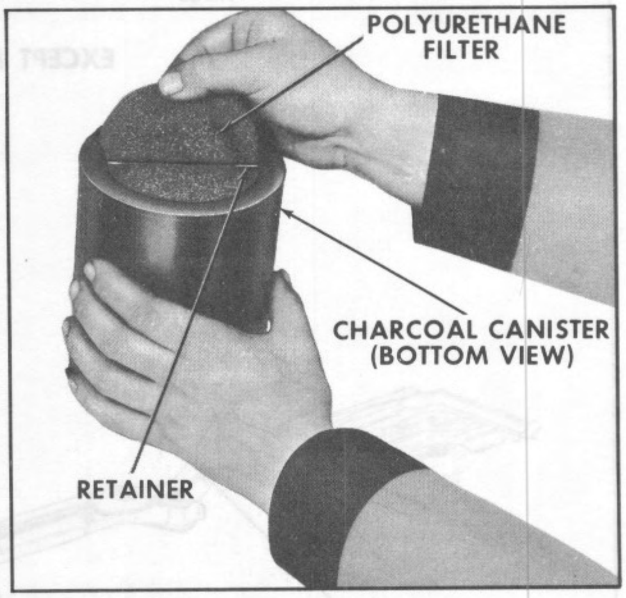


Fig. 6-120 Removing Canister Filter

GENERAL DESCRIPTION

The engine in all Cadillac cars is of the overhead valve, 90° V-8 design. On all cars except Eldorado, the cylinder bore diameter is 4.300 inches and the piston stroke is 4.060 inches, providing a piston displacement of 472 cubic inches. The engine has a compression ratio of 8.25:1. A three-quarter view of the engine and transmission used in these cars is shown in Fig. 6-121.

The Eldorado engine, Fig. 6-122 has a cylinder bore of 4.300 inches and a stroke of 4.304 inches to provide a piston displacement of 500 cubic inches. The Eldorado 500 has a compression ratio of 8.25:1.

Design Features

The cast iron cylinder block is designed with two 90° cylinder banks having four cylinder bores in each bank.

Cylinder numbering is by cylinder arrangement. The right front cylinder is number one, and the left front is number two. Cylinders on the right bank have odd numbers (1, 3, 5, and 7) and those on the left bank have even numbers (2, 4, 6, and 8).

The firing order is 1-5-6-3-4-2-7-8.

The crankshaft is designed to provide a 4.060 or 4.304 inch stroke. The cast nodular iron crankshaft has two and one-half inch diameter connecting rod journals and incorporates five three and one-quarter inch diameter main bearing journals with shell-type inserts of steel-backed aluminum and steel-backed babbitt construction. End thrust of the crankshaft is taken by the center main bearing. Six counterweights are integral with the crankshaft. A harmonic balancer is secured by four screws to a flanged hub pressed on the front end of the crankshaft.

Connecting rods for pistons of opposite cylinders are carried side by side on the same crankpin. Shell type connecting rod bearings are steel-backed with a bearing material overlay.

The cast aluminum pistons use two compression rings and one oil ring. To provide a non-scuffing surface when the engine is new, the pistons are tin-plated.

Piston pins are press-fitted into the connecting rods. Broached grooves in each piston pin bore direct oil from the cylinder wall to the piston pin to provide adequate lubrication.

The camshaft is supported by five steel-backed babbitt bearings. It is driven by the crankshaft through a timing chain at the front of the engine. Both the crankshaft and camshaft sprockets have locating marks to

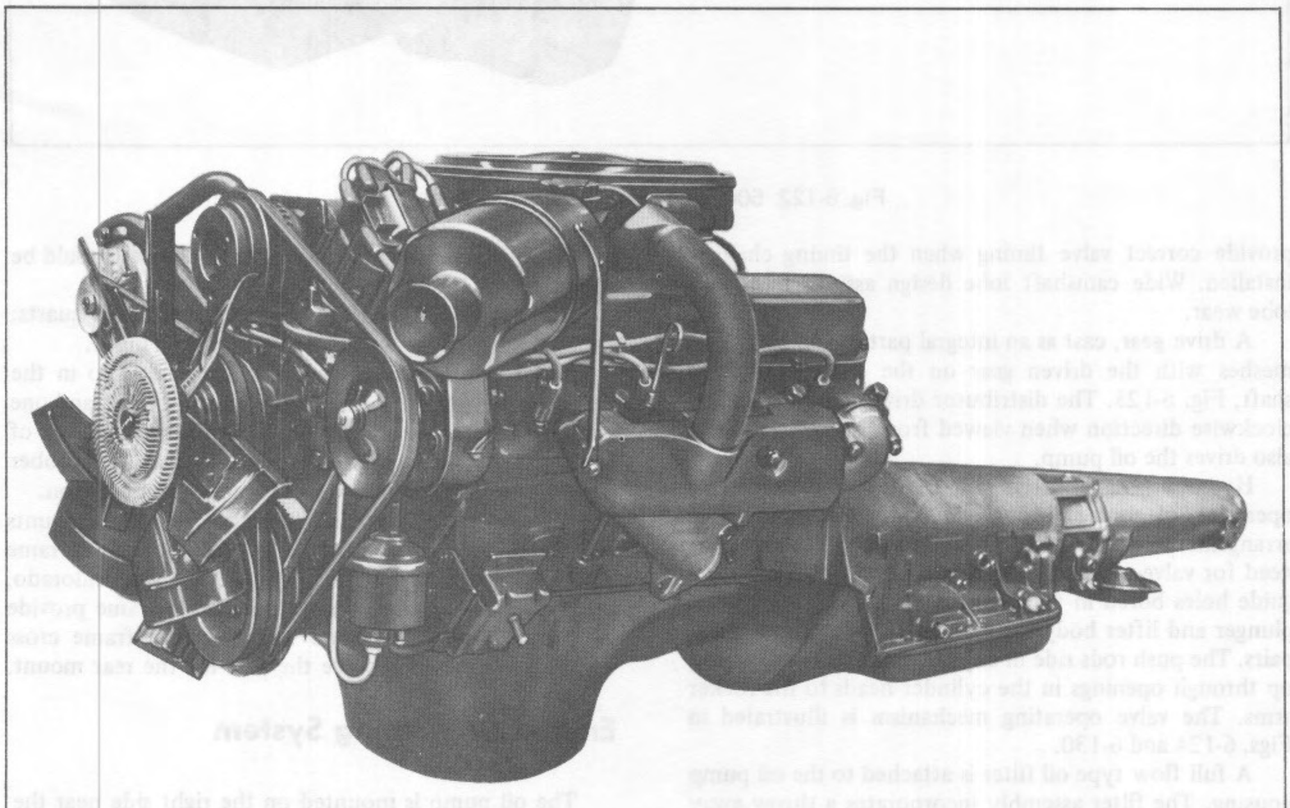


Fig. 6-121 472 Cubic Inch Cadillac Engine

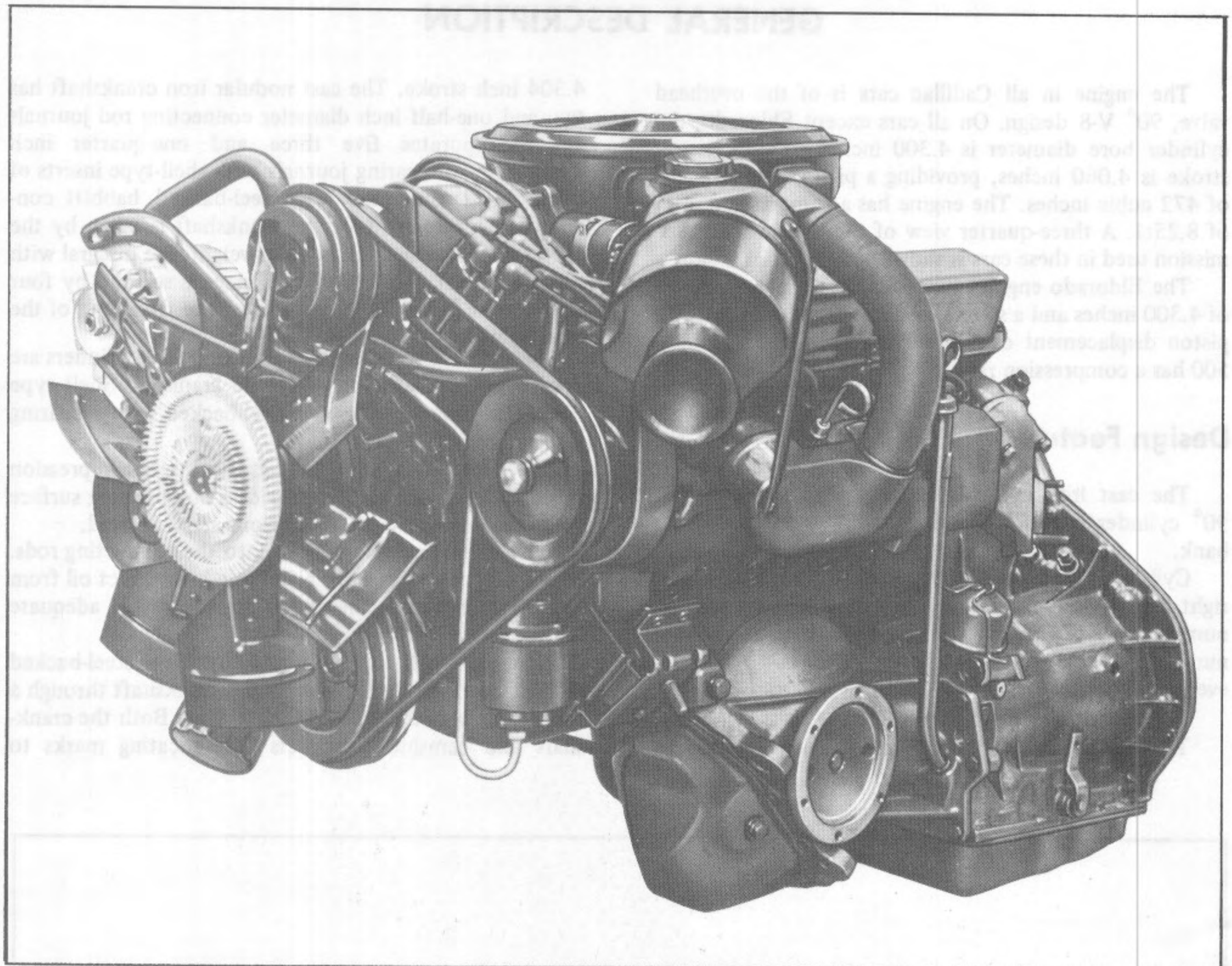


Fig. 6-122 500 Cubic Inch Eldorado Engine

provide correct valve timing when the timing chain is installed. Wide camshaft lobe design assures minimum lobe wear.

A drive gear, cast as an integral part of the camshaft, meshes with the driven gear on the distributor drive shaft, Fig. 6-123. The distributor drive shaft rotates in a clockwise direction when viewed from above. This shaft also drives the oil pump.

Hydraulic valve lifters are used to maintain zero operating clearance throughout the valve train. This arrangement assures quiet operation and eliminates the need for valve tappet adjustments. The lifters operate in guide holes bored in the cylinder block. The valve lifter plunger and lifter body are selectively fitted in matched pairs. The push rods ride in cups in the lifters and extend up through openings in the cylinder heads to the rocker arms. The valve operating mechanism is illustrated in Figs. 6-124 and 6-130.

A full flow type oil filter is attached to the oil pump housing. The filter assembly incorporates a throw away type filter element and a spring loaded by-pass valve integral with the pump assembly, to assure that the engine oil supply is not interrupted if the element should become clogged.

Oil capacity of the engine crankcase on all series cars except the Eldorado is four quarts; five quarts should be added if the filter is changed.

Oil capacity of the Eldorado crankcase is five quarts; six quarts should be added if the filter is changed.

Three engine support mounts are used; two in the front located on each side of the engine block, and one at the rear of the transmission. The front mounts are of a completely encapsulated design in that the rubber cushions in the mounts are always under compression.

On all cars except the Eldorado, the front mounts are seated on the main front cross member of the frame and secured by a nut and washer. On the Eldorado, special mounting brackets welded to the frame provide the front attaching points and a special frame cross member is used to provide the seat for the rear mount.

Engine Lubricating System

The oil pump is mounted on the right side near the front of the engine, Fig. 6-125. Oil enters the pump through a screened intake pick-up pipe, and is pumped through the oil filter, through an angular passage in the cylinder block into the right longitudinal header, Fig. 6-125, and crosses over to the left longitudinal header

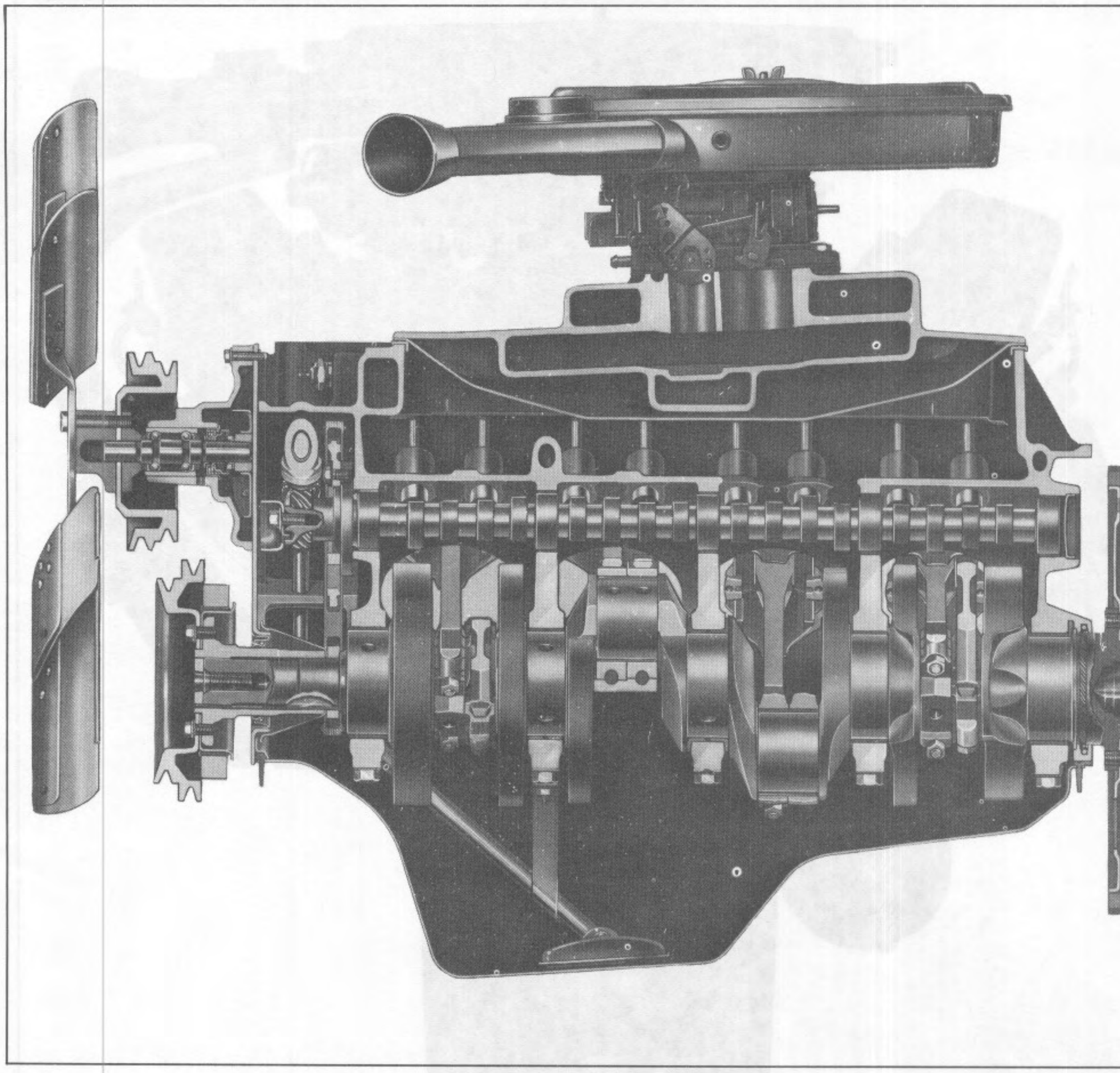


Fig. 6-123 Engine Longitudinal Section

through intersecting vertical passages above the No. 2 camshaft bearing.

The oil continues up the left longitudinal header to the oil pressure signal switch.

Main bearings No. 2, 3, and 4 are lubricated by oil from the right longitudinal header through holes drilled in the block. Main bearings No. 1 and 5 are lubricated in the same manner by oil from the left longitudinal header. The camshaft bearings are lubricated by oil from the corresponding main bearings through holes drilled in the block. Oil from each main bearing also lubricates adjacent connecting rod bearings through holes drilled in the crankshaft, Fig. 6-125.

The longitudinal headers feed the hydraulic valve lifters through drilled passages, Fig. 6-125. The oil then flows under pressure into the lifters and up through the hollow push rods to the rocker arms. The amount of oil is controlled by a small metering disc in the valve lifter.

The oil comes through a small feed hole in the rocker arm and flows onto the arm, lubricating the rocker arm pivot points as well as the push rod tip and the valve tip.

Oil drains from the cylinder heads into the valve lifter compartment and returns to the oil pan through a hole on the bottom of the compartment.

97. Engine Removal and Installation—Except Eldorado

a. Removal

1. Disconnect negative battery cable.
2. Raise rear of car approximately two feet, place drain pan under radiator, and open petcock to drain radiator.
3. Remove self-tapping screw and washer securing each wheelhousing strut to radiator cover and position struts out of way.

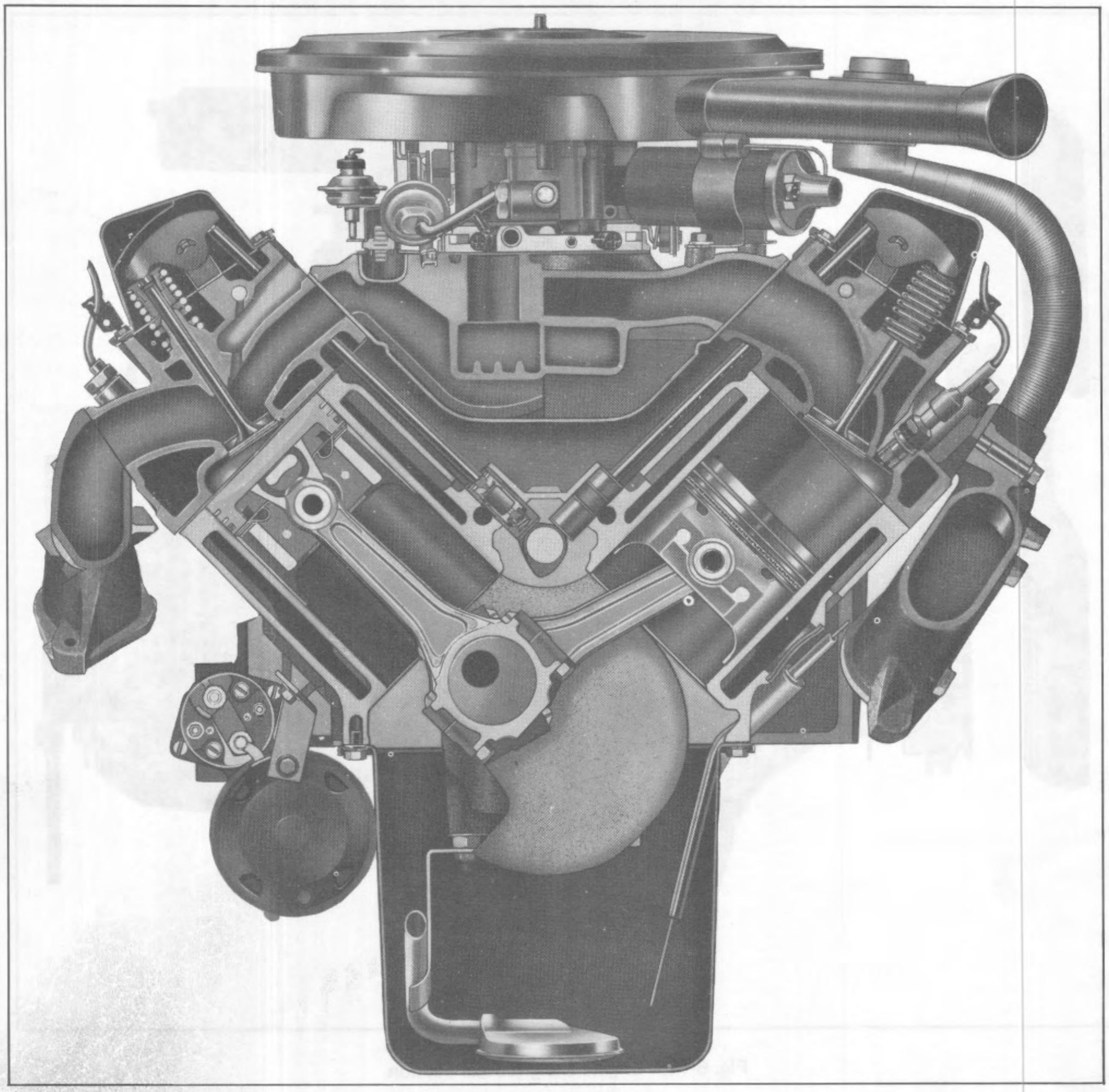


Fig. 6-124 Engine Transverse Section

4. Remove six screws and washers securing radiator cover to cradle and one screw securing upper radiator hose to cover and remove cover.
5. Remove hood as described in Section 11, Note 2.
6. Remove air cleaner and inlet resonator assembly.
7. Disconnect upper radiator hose from thermostat housing.
8. Disconnect wires at the following locations: coolant temperature sender connector (green wire near coil), ignition coil (+ terminal) or HEI connector, downshift switch, engine metal temperature switch, anti-dieseling solenoid, oil pressure switch, heater turn-on switch and A/C compressor.
9. Disconnect wiring harness from support clip and position harness out of way.
10. Disconnect Cruise Control servo from rear of L.H. cylinder head and disconnect brake hose from brake pipe (to left of Cruise Control servo).
11. Disconnect throttle linkage and Cruise Control bead chain at carburetor and position servo assembly out of way.
12. Disconnect vapor canister hose.
13. Disconnect power steering pump as described in Section 9, Note 7a, Steps 2 through 6 and position pump out of way without disconnecting lines or hoses.
14. Remove fan as described in Note 7a or 8a.
15. Reposition drain pan and disconnect lower radiator hose.
16. Remove right side spark plug wires and position out of way.
17. Remove A/C compressor and position out of

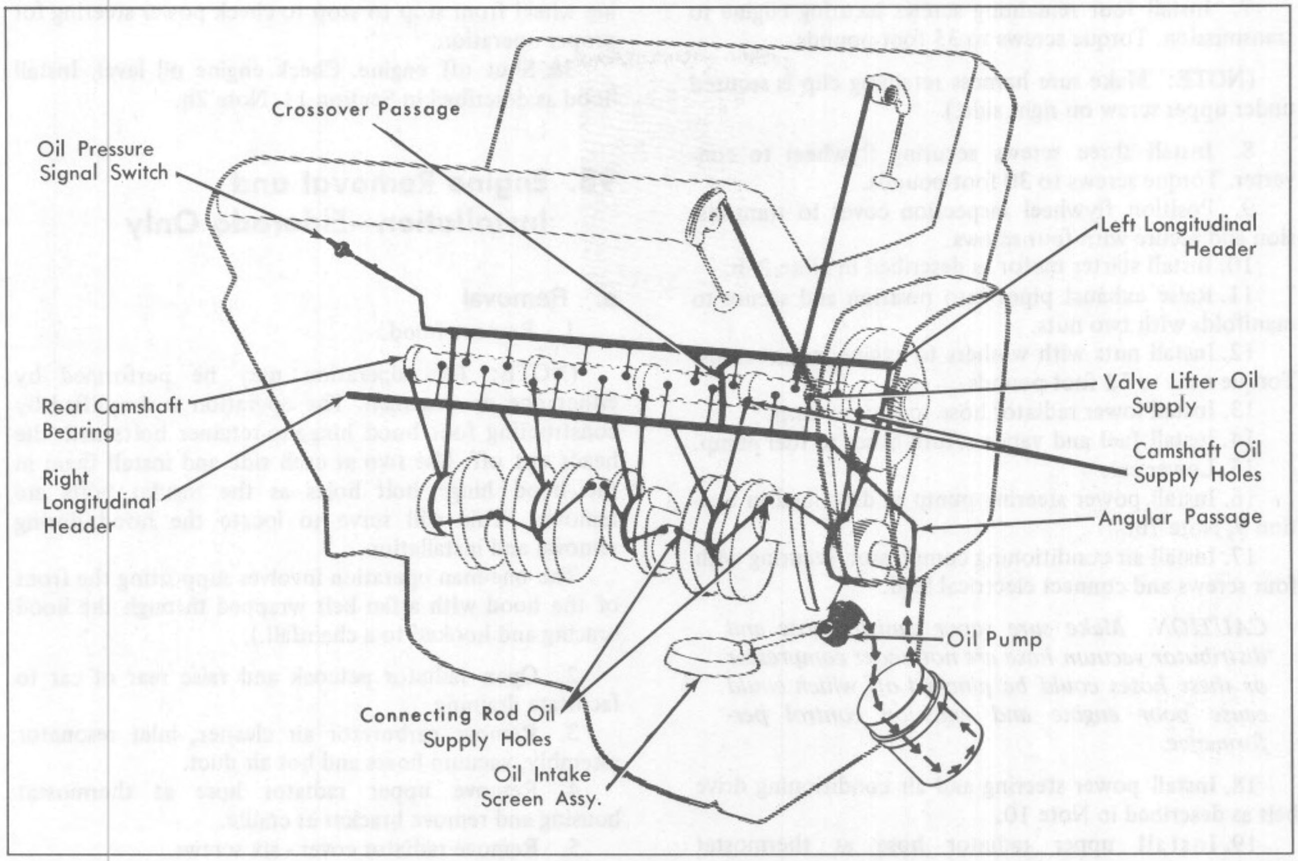


Fig. 6-125 Engine Lubricating System

way on right fender with A/C lines intact, as described in Section 1, Note 10a.

18. Disconnect generator wiring and bend back clips securing wiring harness to right rocker arm cover. Position harness out of way.

19. Disconnect ALC vacuum line on cars so equipped.

20. Disconnect modulator line from back of carburetor.

21. Remove hot water valve hose from fitting in rear of right cylinder head.

22. Remove two nuts securing each cowl-to-wheelhousing tie strut to wheelhousing. Loosen nut securing each strut to cowl and swing struts outboard.

23. Remove top two screws securing transmission to engine.

24. Raise car on hoist.

25. Remove nut and washer securing each engine mount to frame.

26. Remove starter motor as described in Note 26a.

27. Remove four screws securing flywheel inspection cover to transmission and remove inspection cover.

28. Remove screws securing flywheel to converter.

29. Brace exhaust system so that it is supported independently of hangers. Remove two nuts securing exhaust pipe to each exhaust manifold and disengage exhaust system.

30. Disconnect and plug fuel line and vapor return line (A/C cars only) at fuel pump.

31. Lower car.

32. Move right side lifting bracket to a position such that it straddles the intake passage for #1 cylinder.

33. Place lifting chain in lifting brackets and connect chainfall to lifting chain.

34. Raise engine slowly and pull forward to disengage transmission.

35. Raise engine and remove from car.

b. Installation

1. Raise transmission as high as possible.

(NOTE: It may be necessary to support transmission with a separate jack.)

2. Lower engine in chassis on an angle that matches position of transmission. Install two top bolts securing engine to transmission. Right screw also secures transmission dipstick and modulator line.

(NOTE: During this operation use care not to damage any items in the engine compartment (e.g. transmission dipstick tube, throttle linkage, etc.) Some twisting and maneuvering of the engine is sometimes required.)

3. Release the floor jack's support of the transmission, if used.

4. Lower the engine completely, seating the left hand mount first and then the right.

5. Remove lifting equipment.

6. Raise car on hoist.

7. Install four remaining screws securing engine to transmission. Torque screws to 35 foot-pounds.

(NOTE: Make sure harness retaining clip is secured under upper screw on right side.)

8. Install three screws securing flywheel to converter. Torque screws to 30 foot-pounds.

9. Position flywheel inspection cover to transmission and secure with four screws.

10. Install starter motor as described in Note 26b.

11. Raise exhaust pipes into position and secure to manifolds with two nuts.

12. Install nuts with washers to engine mount studs. Torque nuts to 52 foot-pounds.

13. Install lower radiator hose to water pump.

14. Install fuel and vapor return hoses to fuel pump.

15. Lower car.

16. Install power steering pump as described in Section 9, Note 7b.

17. Install air conditioning compressor, securing with four screws and connect electrical lead.

CAUTION: Make sure vapor canister hose and distributor vacuum hose are not under compressor or these hoses could be pinched off which could cause poor engine and emission control performance.

18. Install power steering and air conditioning drive belt as described in Note 10.

19. Install upper radiator hose at thermostat housing.

20. Install fan as described in Note 7b or 8b.

21. Route wiring harnesses along both rocker arm covers and secure with metal tabs.

22. Connect wiring at anti-dieseling solenoid, coil or HEI, coolant temperature sender connector, downshift switch, engine temperature switch, generator, heater turn on switch, and oil pressure switch.

23. Connect vapor canister hose.

24. Install throttle cable at linkage.

25. Install Cruise Control servo unit on rear of cylinder head.

26. Install Cruise Control bead chain securing with small clip.

27. Install brake hose on brake line to left of Cruise Control servo.

28. Reposition cowl-to-wheelhousing struts and tighten all fasteners.

29. Install radiator cover, securing with six screws and secure upper radiator hose brace to radiator cover with one screw.

30. Install both wheelhousing-to-radiator cover struts and tighten all fasteners.

31. Install right side spark plug wires and clips.

32. Connect ALC hose at tee fitting if so equipped.

33. Connect hot water valve hose at rear of right cylinder head.

34. Install air cleaner inlet resonator assembly and connect heat duct.

35. Close drain cock, fill radiator, and install cap.

36. Connect negative battery cable.

37. Test engine for proper operation. Turn on air conditioning and check for proper operation. Turn steering wheel from stop to stop to check power steering for proper operation.

38. Shut off engine. Check engine oil level. Install hood as described in Section 11, Note 2b.

98. Engine Removal and Installation—Eldorado Only

a. Removal

1. Remove hood.

(NOTE: This operation may be performed by either one or two men. The operation is simplified by constructing four hood hinge-to-retainer bolts with the heads cut off. Use two at each side and install them in the hood hinge bolt holes as the regular bolts are removed. This will serve to locate the hood during removal and installation.

The one-man operation involves supporting the front of the hood with a fan belt wrapped through the hood bracing and hooked to a chainfall.)

2. Open radiator petcock and raise rear of car to facilitate draining.

3. Remove carburetor air cleaner, inlet resonator assembly, vacuum hoses and hot air duct.

4. Remove upper radiator hose at thermostat housing and remove bracket at cradle.

5. Remove radiator cover - six screws.

6. Remove fan blade assembly as described in Note 7a or 8a.

7. Disconnect negative battery cable, generator wires, right hand spark plug wires, and heater turn-on switch and position harness out of way. Route spark plug wires away from top of compressor.

8. Disconnect water control valve hose at rear of block. Disconnect starter motor wiring harness at multiple connector.

9. Remove power steering pump (do not disconnect hoses) and position out of way. Remove all drive belts. (Lower power steering pump bolt is most easily removed with 9/16" flex socket, about 9" of extension, and small 3/8" drive ratchet. Position pump with hoses attached near evaporator canister.)

10. Remove A/C compressor mounts (four screws, one nut), disconnect electrical lead and move compressor to top of battery.

11. Disconnect throttle and Cruise Control linkage at carburetor and bracket. Position cables out of way.

12. Disconnect wires on left branch of engine harness (coil, compressor, downshift switch, etc.) and position out of way.

13. Disconnect vacuum lines at rear of carburetor and position out of way.

14. Remove left exhaust manifold flange nuts.

15. Remove transmission cooler line bracket screw and filler pipe nut from exhaust manifold.

16. Change right hand engine lift hook to position over No. 1 intake port.

17. Remove upper screw securing steering gear flex coupling shroud to frame.

18. Raise car on hoist.

(NOTE: A twin post hoist is preferred for this operation.)

19. Remove remaining screw securing steering gear flex coupling shroud to frame and remove shroud.
20. Remove bolt and nut securing final drive bracket to motor mount.
21. Disconnect fuel pump lines and plug.
22. Remove front engine mount nuts and washers.
23. Remove lower radiator hose.

(NOTE: Drain hose and position out of way on bottom of car. Hose clamp is likely to be crushed during installation if not repositioned.)

24. Remove right exhaust manifold flange nuts.
25. Remove starter motor. Do not disconnect wiring from terminals.
26. Remove flywheel inspection cover.

(NOTE: It is possible to perform Step 27 without removing this cover, however, removal of the three accessible bolts is necessary so the cover may be moved to reach converter screws. One cover screw is very difficult to reach.)

27. Remove flywheel-to-converter screws.

(NOTE: Use a 1962 Harmonic Balancer screw - #147 0868 and washer - #147 0867 to turn crankchsft.)

28. Remove two lower transmission-to-block screws.
29. Remove right hand output shaft screws.

(NOTE: This is easily done by one man if a long breaker bar is used. Hold tire with one hand and loosen screw with bar. When all screws are loose, use a small 3/8" drive ratchet with about 18" of extension.)

30. Remove two output shaft bracket to block screws and one screw securing bracket to final drive.
31. Loosen right hand shock absorber lower mounting nut and move shock outward on stud.
32. Move drive axle as far back as possible and remove output shaft.
33. Lower car.
34. Remove four screws securing transmission to block, two at top and two at left hand side of engine.
35. Install lifting chain and chain fall.
36. Place floor jack with a soft (wood) face under transmission pan for support.
37. Remove engine.

b. Installation

1. Install engine.

(NOTE: Use of longer transmission to engine screws will simplify engine locating. Install these bolts in the top two holes. Use of a long screwdriver or pry bar will provide pressure at appropriate points.)

2. Install four transmission to engine screws, two at top and two at left hand side of engine.
3. Remove chain fall, jack and blocks.
4. Raise car.
5. Install two remaining screws securing transmission to engine.
6. Install screws securing converter to flywheel and remove harmonic balancer screw and washer.
7. Secure inspection cover with three screws.
8. Install starter motor.
9. Install output shaft and tighten lower shock mount nut.
10. Install right hand exhaust pipe flange nuts.
11. Install front engine mount nuts.
12. Install bolt and nut securing final drive bracket to left engine mount.
13. Install flex coupling shroud and secure with lower screw.
14. Connect fuel lines.
15. Install lower radiator hose.
16. Lower car.
17. Install fan blade assembly and belts as described in Note 7b or 8b.
18. Install transmission cooler line bracket and dipstick tube bracket.
19. Install throttle and Cruise Control linkage.
20. Install left hand exhaust pipe flange nuts.
21. Install remaining screw securing flex coupling shroud to frame.
22. Install power steering pump.

(NOTE: Lower power steering pump bolt is most easily installed with a 9/16" flexible socket, about 9" of extension, and small 3/8" drive ratchet.)

23. Install A/C compressor.
24. Connect heater hose to right cylinder head.
25. Connect remaining wires and vacuum hoses.
26. Install upper radiator hose.
27. Install radiator cover.
28. Refill coolant.
29. Tension generator and power steering belts.
30. Install battery cable.
31. Install air cleaner, inlet resonator assembly and connect heat duct.
32. Install hood and align.
33. Start engine and check for leaks.

99. Engine and Transmission Support Mount (Except Eldorado)

a. Front Engine Mount Removal (Fig. 6-126)

1. Open hood and remove radiator cover.
2. Raise car on hoist.
3. Remove two through bolts from mount to be replaced (left or right).
4. If left hand (driver's side) mount is being replaced, remove nut and washer from both mounts.
5. If right hand (passenger side) mount is being replaced, remove nut and washer from left hand mount and loosen right hand nut until no threads are visible on stud.
6. Support car with stands at each front frame horn.
7. Apply pressure (hoist, jack, etc.) to oil pan. Apply pressure over entire bottom of sump with no concentration of pressure due to bumps or knobs on lift.

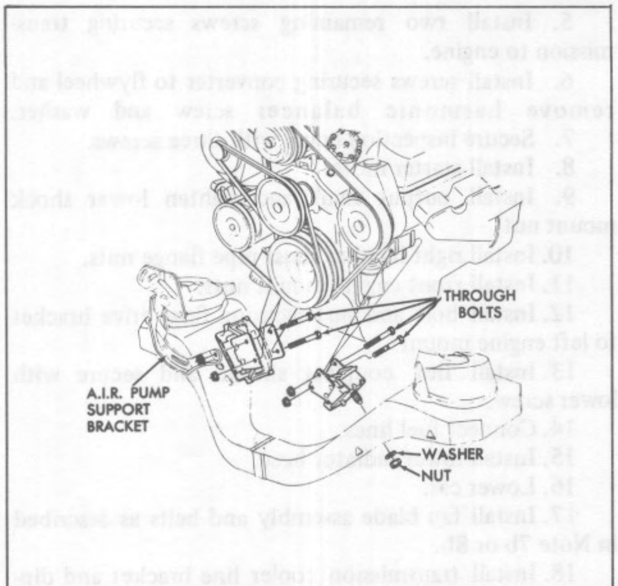


Fig. 6-126 Engine Mounts

8. Raise engine until mount may be removed and remove mount by pulling straight back.

b. Front Engine Mount Installation (Fig. 6-126)

1. Position mount in place between cylinder block and frame.
2. Lower engine until through bolts may be installed through mount from back of mount. It may be necessary to first install lower through bolt, then lower engine carefully, allowing mount to pivot, until upper through bolt mounting holes line up.

(NOTE: On right side, upper through bolt must also pass through A.I.R. mounting bracket.)

3. Continue lowering engine until it is in driving position.
4. Torque through bolt nuts to 21 foot-pounds.
5. Install nut and washer on mount stud and torque nut(s) to 52 foot-pounds.
6. Remove stands and lower car from hoist.
7. Install radiator cover.

c. Transmission Mount Removal

1. Raise car on hoist.
2. Remove two mount to transmission extension housing bolts.
3. Remove two nuts, washers, and bolts securing cross member to frame on each side.

(NOTE: It may be necessary to pry floor pan up for clearance to remove bolts.)

4. Remove parking brake cable from bracket on cross member.
5. Position transmission support under extension housing or oil pan.
6. Remove cross member by raising transmission or lowering vehicle.
7. Remove two nuts and bolts and remove rear mount from position in cross member.

d. Transmission Mount Installation

1. Install rear mount to cross member with weld nuts up and secure with two nuts and bolts.
2. Install cross member and secure with two nuts, washers and bolts at each side.

(NOTE: Bolts should face down with nuts on bottom.)

3. Install two bolts securing mount to transmission extension housing.
4. Install brake cable in bracket at cross member.
5. Remove transmission support.
6. Lower car.

100. Engine and Transmission Mounts—Eldorado Only

a. Left Front Engine Mount Removal

1. Remove radiator cover and disconnect negative battery cable.
2. Raise car and remove nut and washer from engine mount stud.
3. Remove capscrew securing transmission cooler lines to final drive bracket.
4. Remove screw securing top of steering gear flex coupling shroud to frame.
5. Remove nut from large through bolt securing top of engine mount and top of final drive bracket to engine.
6. Raise car and remove nut from lower engine mount through bolt.

(NOTE: Attach box end wrench to nut, then use pry bar between wrench and engine.)

7. Remove remaining screw securing flex coupling shroud to frame and remove shroud.
8. Remove cross bar bolt, nut, and two washers securing bottom of final drive bracket to final drive. Remove bracket by tipping back and to left of car.
9. Using block of wood and jack stand, lift engine from frame at crankshaft pulley to relieve load on engine mount bolts and remove both bolts from mount.
10. Loosen, but do not remove, nut and washer from right engine mount stud.
11. Raise engine sufficiently to remove mount from car. Work mount down and forward between fuel pump and frame.

(NOTE: If interference from fan is encountered, rotate fan blades to a slightly different position.)

b. Left Front Engine Mount Installation

1. Work mount up between frame and fuel pump, engaging mount stud and locating knob in holes in frame.
2. Install lower through bolt from rear of engine mount. Install nut but do not torque at this time.
3. Position final drive bracket and install upper through bolt from rear of engine mount, making sure through bolt properly secures final drive bracket to mount. Install nut but do not torque at this time.
4. Lower engine to normal ride position, making sure stud and locator knob on each mount enter holes in frame.

5. Install bolt, nut, and two washers securing bottom of final drive bracket to final drive, tightening to 65 foot-pounds.

6. Torque nuts on both through bolts to 20 foot-pounds.

7. Torque nut and washer securing right engine mount to frame to 52 foot-pounds.

8. Install nut and washer securing left engine mount to frame, tightening to 52 foot-pounds.

9. Secure transmission cooler lines to final drive bracket with one screw and clip.

10. Position flex coupling shroud on frame and install lower screw.

11. Lower car.

12. Install upper flex coupling shroud mounting screw.

13. Install radiator cover. Connect negative battery cable, tightening to 70 inch-pounds.

c. Right Front Engine Mount Removal

1. Remove six screws securing radiator cover to radiator cradle and one screw securing upper radiator hose bracket to cover and remove cover.

2. Remove nut and washer securing left engine mount to frame.

3. Raise car.

4. Remove nut and washer securing right engine mount to frame.

5. Reach between right engine mount and oil pump to attach open end wrench to nut on lower bolt securing engine mount to engine block. Holding this wrench in place, remove lower mounting bolt from rear, using ratchet, U-joint socket, and about 18" of extension.

6. Work end wrench up between oil pump and crankshaft pulley and position wrench in a straight vertical position to engage nut on upper mounting bolt. Holding wrench in place, use same tools as in Step 5 to remove upper mounting bolt.

(NOTE: If nut is impossible to engage, an alternative is to first perform Step 7, then use a 5" extension and a 9/16" crowfoot adapter and engage tool on nut by slipping between oil pump and A.I.R. pump.)

7. Place jackstand under crankshaft pulley and, using wood block to avoid damage to pulley, either raise engine or lower chassis enough to remove mount.

CAUTION: When separating engine and chassis, observe relative position of frame rail and right drive axle tri-pot housing. Interference between these parts requires removal of right drive axle before mount can be removed. Furthermore, if tri-pot housing does clear the frame, vertical movement is limited by presence of fuel lines. Do not allow tri-pot housing to contact fuel lines.

8. Work mount free and pull rearward over tri-pot housing to remove from car.

d. Right Front Engine Mount Installation

1. Position mount between engine and frame.

2. Install upper mounting bolt and nut securing engine mount to engine.

3. Install lower mounting bolt and nut securing mount to engine.

4. Torque upper and lower mounting bolts and nuts to 20 foot-pounds.

5. Lower engine into chassis, making sure each mount stud and locater engages its mounting hole in frame.

6. Install nut and washer securing right mount to frame, tightening to 52 foot-pounds.

7. Lower car.

8. Install nut and washer securing left mount to frame, tightening to 52 foot-pounds.

9. Secure radiator cover with six screws and install upper radiator hose and bracket on radiator cover.

e. Transmission Mount Removal (Fig. 6-127)

1. Raise car on hoist.

2. Remove two screws securing transmission mount to frame cross bar, Fig. 6-127.

3. Place jack stand under transmission pan. Use a block of wood to protect pan.

4. Lower chassis slightly to relieve vertical load on mount.

5. Remove three screws securing mount to transmission bracket and remove mount.

f. Transmission Mount Installation

1. Position mount against rear of transmission bracket and secure with three screws, tightening to 25 foot-pounds.

(NOTE: While performing this step observe alignment of holes in mount and holes in frame to make sure installation of screws will be possible.)

2. Raise chassis so that transmission is in normal ride position and transmission mount assumes normal load.

3. Install two screws securing transmission mount to frame cross bar, tightening to 25 foot-pounds.

4. Remove jack stand and wood block from under transmission pan and lower car.

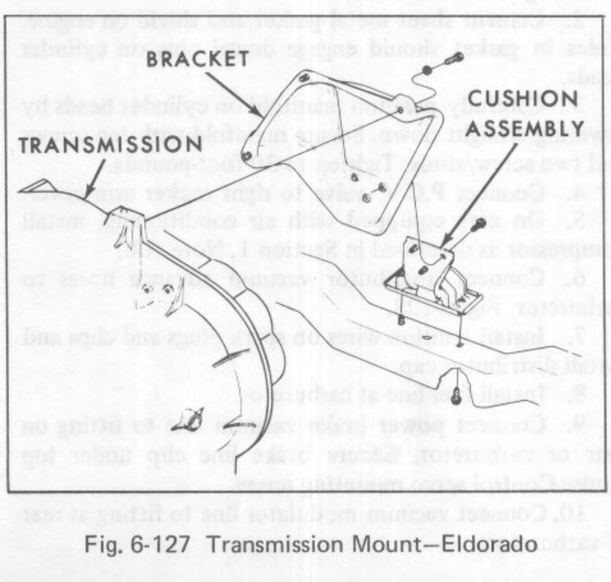


Fig. 6-127 Transmission Mount—Eldorado

101. Intake Manifold

a. Removal

1. Disconnect negative battery cable.
2. Remove air cleaner, (separate from resonator assembly) heat tube, and crankcase ventilating breather.
3. Disconnect carburetor and Cruise Control linkage at throttle adapter plate.
4. Disconnect all coil wires or HEI connector.
5. Remove distributor cap.
6. Disconnect single connector near ignition coil (green wire to temperature sender).
7. Disconnect two orange wires from downshift switch. Disconnect anti-dieseling solenoid.
8. Remove ignition coil, anti-dieseling solenoid, and bracket from manifold.
9. Disconnect power brake vacuum line and vacuum modulator line from rear of carburetor. Remove top mounting bolt from Cruise Control servo and position brake line out of way.
10. Disconnect double connector from compressor clutch on cars equipped with air conditioning.
11. Disconnect air conditioning system vacuum hose from rear of manifold.
12. Disconnect fuel line at carburetor and move slightly out of way.
13. Disconnect distributor vacuum advance hoses at carburetor and position out of way.
14. On cars equipped with air conditioning, partially remove compressor as described in Section 1, Note 10a.
15. Disconnect PCV valve from right rocker arm cover.
16. Remove ten screws and two screw/studs securing manifold to cylinder heads and remove manifold.
17. Remove sheet metal manifold shield and gasket.
18. Remove rubber front and rear manifold to cylinder block gasket.

b. Installation

1. Place rubber seals over rails at front and rear of cylinder block. Tabs on gasket should be positioned in holes in rails and beveled ends of gasket tucked into slot at mating of head and rail.
2. Cement sheet metal gasket and shield on engine. Holes in gasket should engage dowel pins on cylinder heads.
3. Carefully position manifold on cylinder heads by lowering straight down. Secure manifold with ten screws and two screw/studs. Tighten to 30 foot-pounds.
4. Connect P.C.V. valve to right rocker arm cover.
5. On cars equipped with air conditioning, install compressor as described in Section 1, Note 10b.
6. Connect distributor vacuum advance hoses to carburetor, Fig. 6-128.
7. Install ignition wires on spark plugs and clips and install distributor cap.
8. Install fuel line at carburetor.
9. Connect power brake vacuum line to fitting on rear of carburetor. Secure brake line clip under top Cruise Control servo mounting screw.
10. Connect vacuum modulator line to fitting at rear of carburetor.

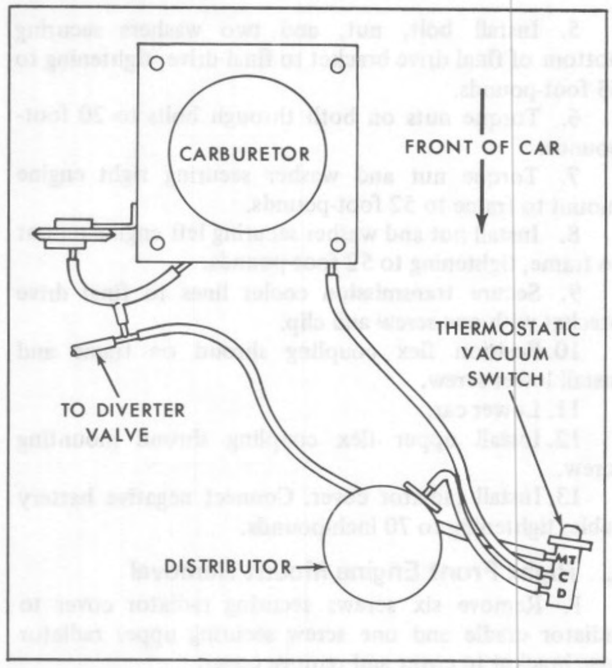


Fig. 6-128 Distributor Vacuum Hose Schematic

11. On cars equipped with air conditioning, connect double connector to compressor clutch.
12. Connect single connector near coil (green wire to temperature sender).
13. Install coil, anti-dieseling solenoid, and bracket on manifold.
14. Connect primary wires to coil terminals and connect high tension lead to coil tower, or connect HEI.
15. Install orange/black and orange/white wires to downshift switch. Connect anti-dieseling solenoid to wiring harness.
16. Connect Cruise Control and throttle linkage at throttle adapter plate.
17. Install air cleaner bottom making sure heat tube engages heat shield on exhaust manifold and snorkel engages inlet resonator.
18. Carefully install crankcase ventilating breather. Install and tighten air cleaner cover.
19. Install Automatic Level Control, hose to air cleaner.
20. Check routing of all hoses around carburetor to make sure they do not interfere with the proper operation of the throttle linkage.
21. Connect negative battery cable.
22. Start engine and inspect for leaks.

102. Exhaust Manifold-Right or Left

a. Removal

1. If working on left manifold, remove carburetor air cleaner and heat duct. Remove nuts from #2 and #8 cylinder (#2 and #6 on Eldorado only) manifold studs and remove air cleaner support rod and heat shroud from around manifold.
2. Remove two nuts securing header pipe to exhaust manifold at side being worked on.
3. Remove eight screws securing exhaust manifold

to cylinder head. If working on left manifold on an Eldorado, Also remove clip securing dipstick tube.

(NOTE: Fifth screw from front may not be removable due to frame interference. If so, back screw off all the way and remove with manifold in Step 4.)

4. Remove exhaust manifold from position in engine compartment.

b. Installation

1. Lubricate cylinder head mounting surfaces of the exhaust manifold with a thin coat of a moly-based lubricant (graphite).
2. Insert fifth screw from front in manifold and position manifold in location on cylinder head.
3. Install remaining screws. If working on left manifold, install screw/stud in front attaching hole of #2 cylinder and rear attaching hole of #8 cylinder (front hole of #2 and #6 on Eldorado only). Torque all screws to 35 foot-pounds.

(NOTE: If working on Eldorado left manifold secure dipstick tube retaining clip under one screw.)

4. If working on left manifold, position heat shroud and air cleaner support rod to exhaust manifold and secure with two nuts.
5. Move exhaust pipe into position at manifold and secure with two nuts.
6. If working on left manifold, install carburetor air cleaner making sure heat duct engages heat shroud on manifold.

103. Rocker Arm Covers

a. Removal

1. If working on left side, remove air cleaner, heat duct, and crankcase ventilating breather.
2. If working on right side, remove PCV valve and elbow from cover. Remove generator wiring harness from clips.
3. Remove spark plug cable clips from studs, Fig. 6-129, and position out of way.
4. Remove seven screws and two screw studs holding cover to head and remove cover.

(NOTE: If cover removal is difficult, use hammer and block of wood to loosen. Do not pry on rocker arm cover.)

b. Installation

1. Using a new gasket, position cover on cylinder head and secure with nine screws. Screw/studs should be installed in locations shown in Fig. 6-129. Tighten screws to 30 inch-pounds.
2. Position spark plug cable clips on studs, Fig. 6-129.
3. If working on right side, install PCV valve and

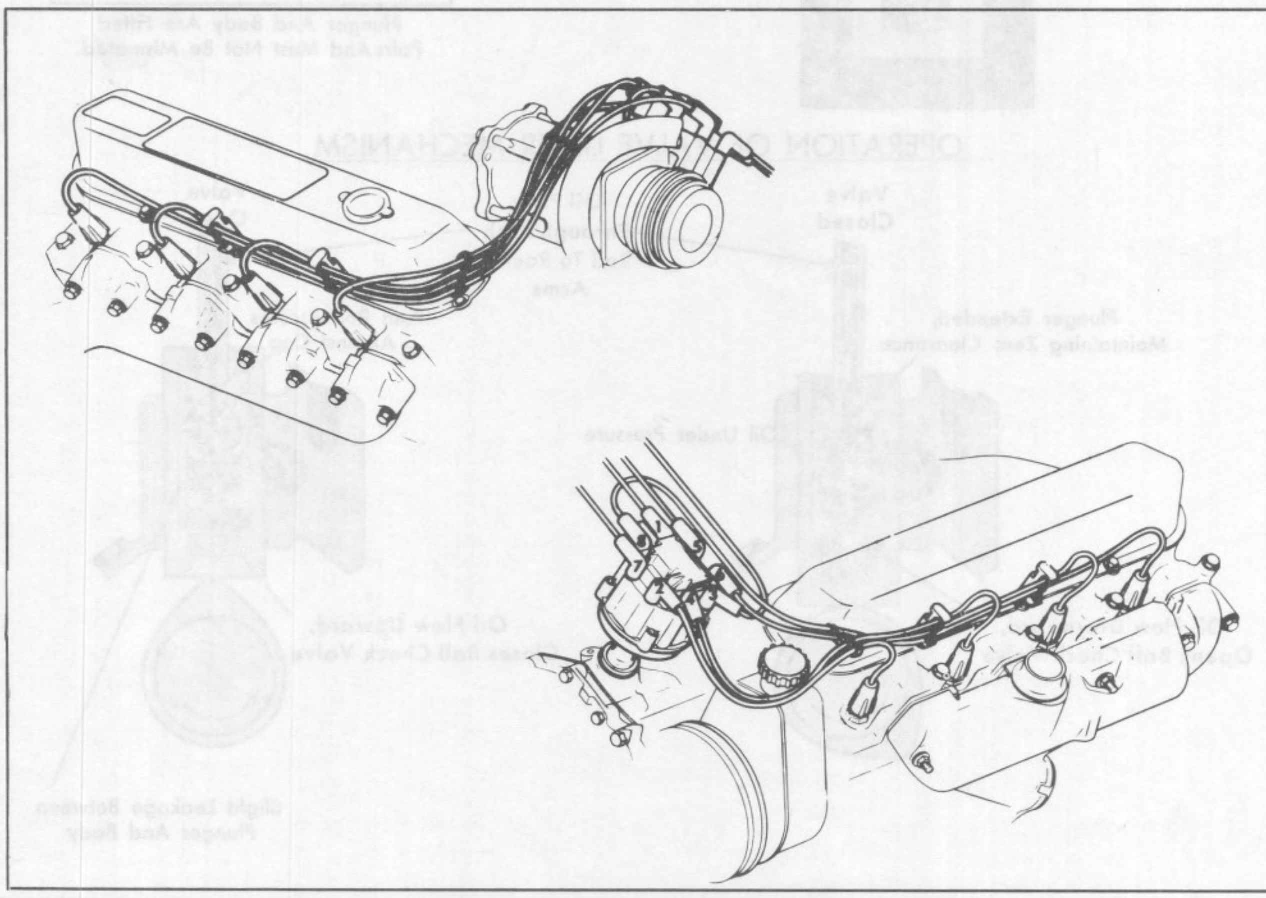


Fig. 6-129 Spark Plug Wire Routing

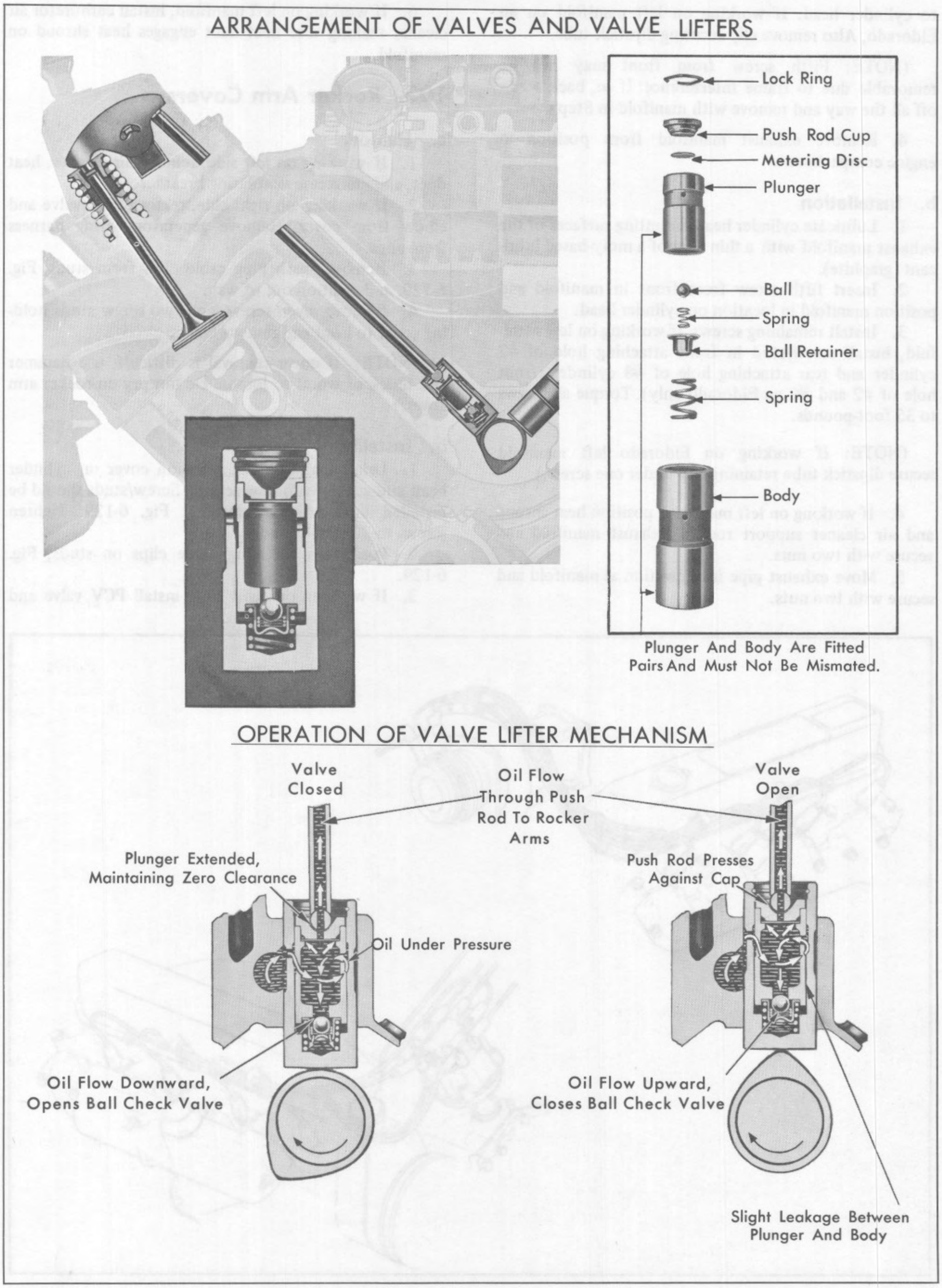


Fig. 6-130 Valve Lifter Mechanism

elbow. Reposition generator wiring harness under clips.

4. If working on left side, install crankcase ventilating breather and air cleaner, making sure heat duct engages heat shroud on exhaust manifold.

104. Valve Train Diagnosis

Poor engine performance or noisy engine operation may be caused by worn or damaged parts in the valve train. If valve problems are indicated such as by a compression test, camshaft speed engine noise, excessive oil consumption, etc, remove rocker arm covers and inspect the following valve train components.

1. Valve spring
2. Valve spring retainer and oil shedder.
3. Rocker arm, retainer and support.
4. Pushrod
5. Valve stem
6. Valve guide

Noisy operation of valve lifters may be due to:

a. Incorrect Engine Oil Level

Oil level should never be above, nor more than a quart below "Full" mark on indicator. If level is too high, foaming may result, if too low, air may enter pump inlet. In either case, noisy valve action may result.

b. Improper Oil Pressure

If valve action is noisy after the oil is hot, it may be due to low oil pressure.

Low pressure usually results from an external leak in the engine lubrication system, a stuck or improperly operating oil pressure relief valve, scored parts, worn bearings, worn oil pump gears, clogged oil intake strainer screen assembly, or poor operation of oil pump.

c. Rusty or Varnished Valve Stems or Valve Guides

This condition may be associated with short trip operation, poor quality engine oil, or failure to change oil regularly.

d. Weak Valve Lifter Springs

These can cause noisy valve operation by causing sluggish plunger movements in the cylinder. To check these springs, disassemble plunger assembly, clean thoroughly and reassemble. Check pressure to compress spring with lifter dry.

If pressure required to compress spring 11/32 inch is less than 6-1/4 pounds, the assembly should be replaced.

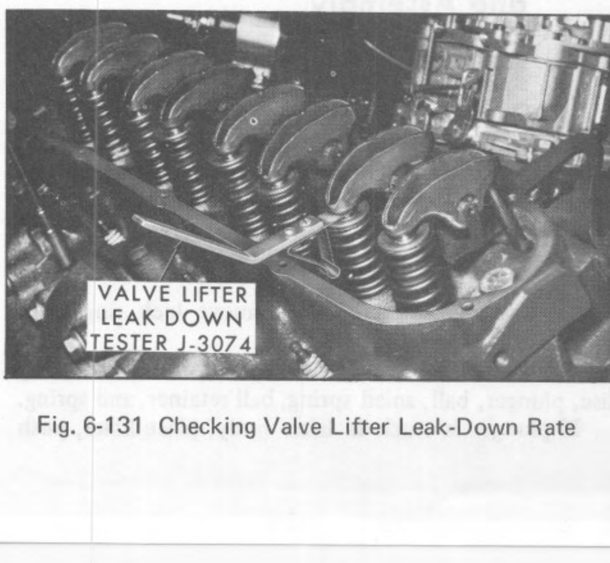


Fig. 6-131 Checking Valve Lifter Leak-Down Rate

e. Dirty, Worn, or Scored Valve Lifter Parts

A recurring tap or click synchronized with valve action, indicates trouble in a single lifter assembly, which should be disassembled and checked for:

1. Dirt or foreign particles, which can be removed after disassembly by wiping with a soft cloth and washing in kerosene.

2. Varnish or heavy sludge material, which can be removed with solvent.

(NOTE: The engine oil pan should always be removed and cleaned when dirt has been responsible for sticking lifters. The oil passages from the header to the lifter bores should also be cleaned thoroughly by blowing out with kerosene and air.)

3. Pitting and scoring of surfaces, which may result from gritty particles, excessive wear, poor grade oil, or damage during installation. This condition requires replacement of the complete unit.

4. Incorrect clearance between cylinder and plunger, usually caused by mismating of parts. These parts are selectively fitted in manufacturing and are not interchangeable.

f. Lifters That Do Not Turn In Their Bores

Scoring, surface flaking, cupping, or excessive wear on the bottom of the lifter may prevent the lifters from turning in their bores.

g. Other Causes

Excessive wear on either end of rocker arm or at rocker arm support; worn valve stems; worn or bent push rods; worn camshaft lobes; air in suction side of oil pump system.

105. Valve Lifter Leak-Down Rate Checking

The Valve Lifter Leak-Down Rate Tester, J-3074, is used to obtain a comparison of leak-down rates of hydraulic valve lifters without removing them from the engine. With this tool, a feeler gage of a given thickness is placed between the rocker arm and the valve stem, causing valve spring pressure to force oil out of the lifter. A spring, attached to the tool and compressed against the valve spring retainer, ejects the feeler gage when the lifter has leaked down enough to allow the valve to seat. By observing the length of time required by each lifter to leak-down the thickness of the feeler gage, a faulty lifter or lifters can be easily located.

Use the following procedure:

1. Operate engine to allow lifters to fill with oil.

2. Turn off engine. Remove distributor cap and rotate crankshaft so that rotor is at No. 1 firing position.

3. Remove carburetor air cleaner.
4. Disconnect negative battery cable.
5. Disconnect spark plug wires at plugs and remove wiring from tabs on rocker arm covers, but leave wiring connected.
6. Remove rocker arm covers as described in Note 103a.
7. Check each lifter listed in following table as shown in Fig. 6-131.

Rotor at No. 1 firing position.
Check:

1 Intake	1 Exhaust
2 Intake	3 Exhaust
5 Intake	5 Exhaust
7 Intake	6 Exhaust
8 Intake	8 Exhaust

8. Insert feeler gage of tool between valve stem and rocker arm and at the same time, compress tool "pop-out" spring to its stock against valve spring retainer, Fig. 6-131.

(NOTE: Install tool as quickly as possible to eliminate any unnecessary lifter leak-down.)

9. Note interval of time during which tool is held in place by valve spring pressure. The noisy lifter or lifters will have the shortest leak-down time.
10. Connect negative battery cable, install distributor cap, connect spark plug wires, and operate engine to allow lifters again to fill up with oil.
11. Turn off engine, remove distributor cap and rotate crankshaft so that rotor is at No. 4 firing position. Disconnect spark plug wires and negative battery cable.
12. Check each lifter listed in the following table:

Rotor at No. 4 firing position.
Check:

3 Intake	2 Exhaust
4 Intake	4 Exhaust
6 Intake	7 Exhaust

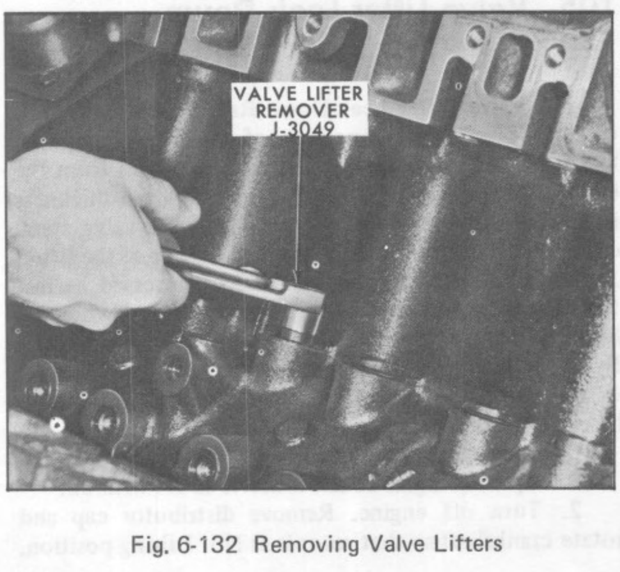


Fig. 6-132 Removing Valve Lifters

13. Install rocker arm covers as described in Note 103b.
14. Install distributor cap.
15. Install carburetor air cleaner.
16. Connect negative battery cable.
17. Operate engine to obtain operating temperature and retorque rocker arm cover screws to 30 inch-pounds.

106. Valve Lifter

a. Removal

1. Remove intake manifold as described in Note 101a.
2. Remove rocker arm covers as described in Note 103a.
3. Remove screws securing rocker arm supports to cylinder heads.
4. Remove rocker arm assemblies. Store rocker arm assemblies so that they can be reinstalled in same location.
5. Remove push rods.
6. Using a small screwdriver, or pointed tool, remove lifters from engine. Keep them in order so they can be re-installed in same bores from which they were removed. Use Valve Lifter Remover, J-3049, to remove any lifters that are stuck, rotating lifter back and forth while lifting, Fig. 6-132.

b. Installation

1. Apply a small amount of rear axle lubricant to foot of each lifter.
2. Install valve lifters in same bores from which they were removed.
3. Install push rods through openings in cylinder heads. Bottoms of push rods must be seated in hydraulic valve lifter cups.
4. Install rocker arm assemblies on cylinder heads securing with screws. Tighten screws to 60 foot-pounds.
5. Position new rocker arm cover gaskets on cylinder heads.
6. Install rocker arm covers as described in Note 103b.
7. Install intake manifold as described in Note 101b.

107. Valve Lifter Disassembly and Assembly

a. Disassembly

(NOTE: Valve plungers and bodies are matched in pairs and are not interchangeable with one another. In order to fit properly, they must be reassembled to their original matching pairs.)

1. Press down on center of valve lifter push rod cup.
2. Using a pointed tool, remove lock ring from groove while holding cup down.
3. Invert lifter and slide out push rod cup, metering disc, plunger, ball, small spring, ball retainer, and spring.

If plunger is stuck in lifter body, place lifter, push

rod end down, in Valve Lifter Plunger Remover, J-4160, Fig. 6-133. Holding tool firmly in hand with thumb over lifter body, strike tool sharply on block of wood or wooden bench until plunger falls out of body.

b. Assembly

1. Place ball on its seat in lower end of plunger while holding plunger upside down. Place small spring on ball.
2. Position ball retainer over small spring and ball and snap into recess in plunger.
3. Place spring over ball retainer.
4. Lower lifter body over plunger assembly on an angle to seat spring.
5. Turn assembly right side up and fill plunger with clean engine oil.
6. Jiggle ball with small piece of wire until oil drains out of plunger into body and trapped air is released from body.
7. Refill plunger with oil, place oil metering disc and push rod cup on plunger, and position lock ring over cup.
8. Press lock ring into groove with Valve Lifter Lock Ring Installer, J-2730, Fig. 6-134.

108. Valve Spring or Oil Shedder Replacement

a. Removal

1. Remove carburetor air cleaner.
2. Remove rocker arm cover as described in Note 103a.
3. Remove rocker arm assembly from cylinder head.
4. Remove push rods.
5. Remove spark plug.
6. Connect air hose to Adapter J-22794 and supply air to cylinder.
7. Install rocker arm support screw.
8. Install Valve Spring Compressor, J-22765, over rocker arm stand screw, Fig. 6-135.

Fig. 6-133 Removing Stuck Plunger From Body

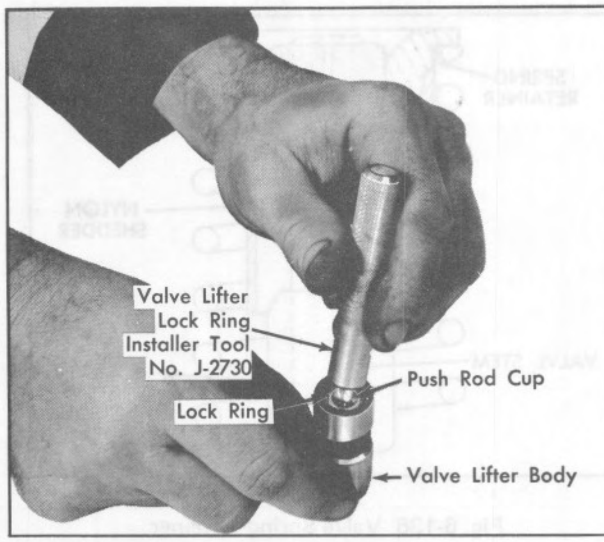


Fig. 6-134 Lock Ring Installation

9. Compress valve spring and remove locks from valve stem.

(NOTE: A sharp blow on a socket placed on top of the retainer will help break loose any stuck locks.)

10. Lift out spring retainer with nylon shedder and spring, Fig. 6-136. Discard retainer-shedder.
11. Clean gasket material off cylinder head and rocker arm cover.

b. Installation

1. Install valve spring and new retainer-shedder assembly, Fig. 6-136.
2. Using Valve Spring Compressor, J-22765, compress valve spring and install locks, Fig. 6-136.
3. Bleed air out of cylinder and remove air hose and Adapter, J-22794

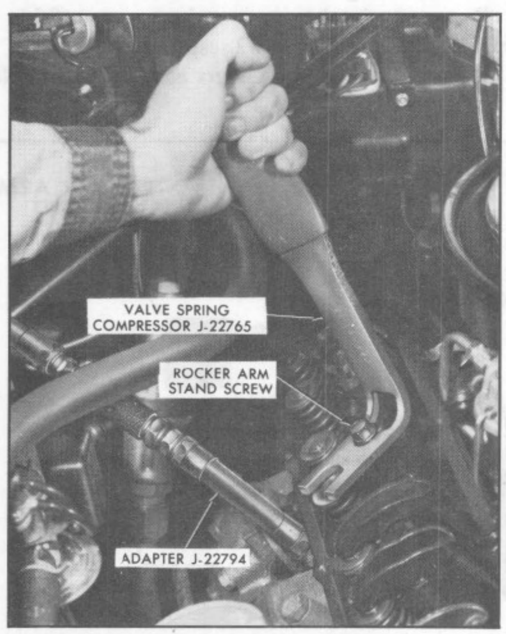


Fig. 6-135 Compressing Valve Spring

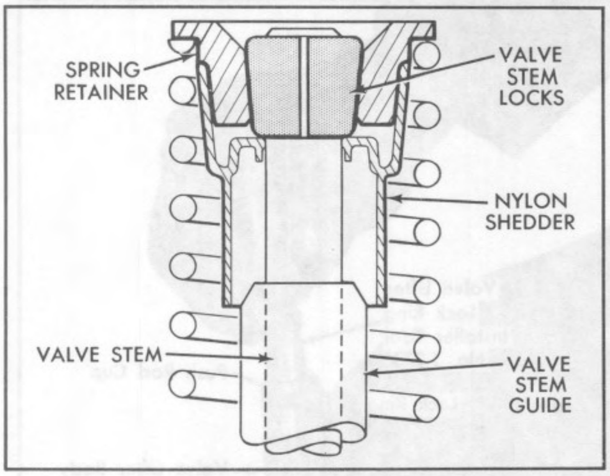


Fig. 6-136 Valve Spring Retainer

4. Install spark plug.
5. Remove rocker arm support screw.
6. Install push rods.
7. Position rocker arms on rocker arm support. Fig. 6-137.
8. Position retainer on rocker arm supports.
9. Position rocker arm assembly on cylinder head and secure with screws. Tighten screws to 60 foot-pounds.
10. Position new rocker arm cover gasket on cover.
11. Install rocker arm cover as described in Note 103b.
12. Install carburetor air cleaner, making sure heat duct engages heat shroud on exhaust manifold.
13. Run engine and check for oil leaks.

109. Cylinder Head

a. Removal

1. Drain cooling system.
2. Remove intake and exhaust manifolds as described in Notes 101 and 102 respectively.
3. Remove rocker arm covers as described in Note 103a.

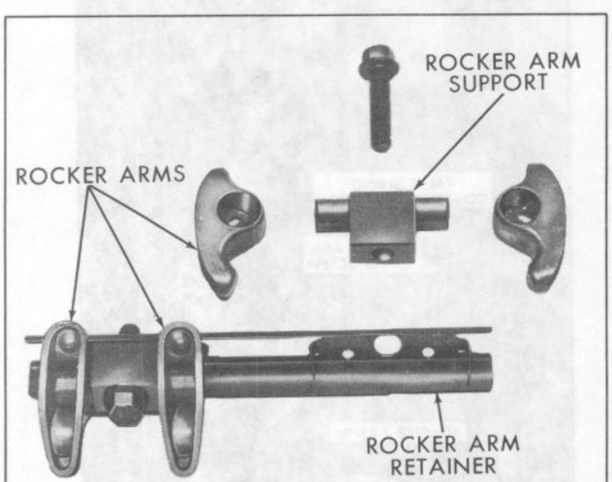
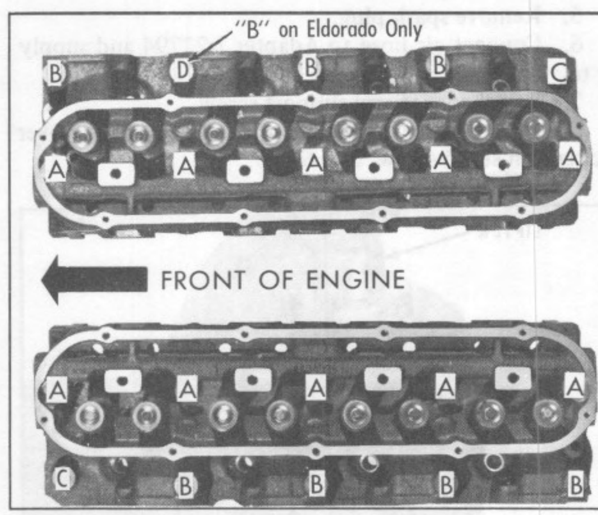


Fig. 6-137 Rocker Arms Disassembled

4. Disconnect electrical and ground connections from cylinder head.
5. Partially remove power steering pump as described in Section 9, Note 7a, if working on left cylinder head.
6. If working on right head, remove heater hose from rear of head. Remove generator as described in Note 47, and remove A.I.R. pump as described in Note 88.
7. Remove screws securing rocker arm supports to cylinder head.
8. Remove rocker arm assemblies. Store assemblies so that they can be reinstalled in same location.
9. Remove push rods.
10. Install two 7/16-14 x 6" screws, to be used as lifting handles, in two of the rocker arm support screw holes.
11. Remove ten cylinder head screws and lift head from block.
12. Carefully remove all gasket material from mating surface of cylinder head and cylinder block and cylinder head and rocker arm cover mating surfaces.

b. Installation

1. Use extreme caution to insure that all mating surfaces of cylinder head and cylinder block are clean.
2. Position cylinder head gasket over dowels on cylinder block.
3. Position cylinder head on cylinder block.
4. Install ten cylinder head screws finger tight in locations as indicated in Fig. 6-138.
5. Tighten cylinder head screws to 115 foot-pounds starting from center of cylinder head and working toward both ends.



Bolt Location	Length
A (Bolt)	4.36" (Medium)
B (Bolt)	4.77" (Long)
C (Bolt)	3.02" (Short)
D (Bolt/stud)	4.77" (Long)

Fig. 6-138 Cylinder Head Screws

6. Remove two 7/16-14" x 6" screws used for lifting handles.

7. Install push rods through openings in cylinder head. Bottom of push rod must be seated in hydraulic valve lifter cup.

8. Position rocker arm assemblies on cylinder heads in same positions as found on disassembly and secure with screws. Tighten screws to 60 foot-pounds, Fig. 6-138.

9. Install rocker arm cover as described in Note 103b.

10. Install exhaust and intake manifolds as described in Notes 101 and 102 respectively.

11. If working on left cylinder head, install power steering pump as described in Section 9, Note 7b. Connect high temperature warning wiring connector at rear of head.

12. If working on right cylinder head, install A.I.R. pump as in Note 88, install generator as described in Note 47, and connect heater hose at rear of head.

13. Refill cooling system.

14. Start engine and allow it to reach normal operating temperature. Check torque on rocker arm cover screws. Check for coolant and oil leaks.

110. Valve (Intake or Exhaust)

a. Removal

1. Remove cylinder head as described in Note 109a.

2. Set cylinder head on clean work bench. Position cylinder head on intake manifold surface.

3. Position valve spring compressor over valve, Fig. 6-139 and compress valve spring.

4. Remove valve locks.

5. Slowly release tension on valve spring compressor and remove compressor.

6. Remove valve spring retainer with nylon shedder and spring, from cylinder head Discard valve spring retainer-shedder assembly.

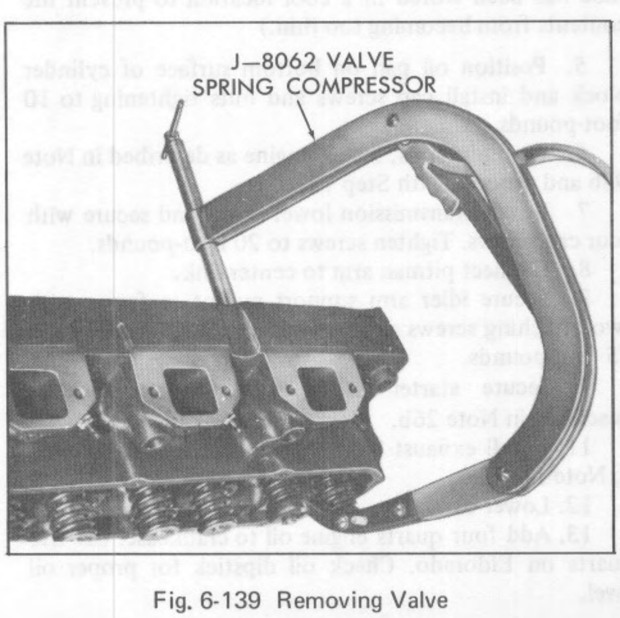


Fig. 6-139 Removing Valve

7. Remove valve from cylinder head.

8. Repeat Steps 3 through 7 for remaining valves to be serviced.

b. Installation

1. Position valve and spring onto cylinder head.

2. Position new valve spring retainer-shedder assembly on valve stem.

3. Engage valve and retainer with valve spring compressor, Fig. 6-139, and compress valve spring.

4. Install valve locks on valve stems.

5. Slowly release tension on valve spring compressor and remove valve spring compressor.

6. Repeat Steps 1 through 5 for remainder of valves to be installed.

7. Install cylinder head on engine as described in Note 109b.

111. Valve and Seat Reconditioning

Valve reconditioning is normally required less frequently in engines having hydraulic valve lifters. When this work is done, the close limits given in the engine specifications, Pages 6-132 and 6-133 must be maintained.

Check valve stem to guide clearance using a hole gage and an outside micrometer. Measure valve guide inside diameter with hole gage, crossways to engine, at both top and bottom of guide, measuring gage each time with micrometer. A standard size valve guide is .343" in diameter.

Measure valve stem diameter with micrometer and subtract from greater of two guide measurements to obtain maximum clearance. If clearance is greater than .005 inch, guide should be reamed to oversize to prevent excessive oil consumption and improper seating of valves.

An alternate method of checking valve stem to guide clearance, if a hole gage is not available, is by using a 1/16 inch wide strip of .005 inch brass shim stock on a "no-go" basis.

Bend end of shim and hang in end of valve guide, with tip extending towards push rod side of head. Shim should not extend more than 1/4 inch into guide. If valve stem will enter guide, clearance is excessive and guide should be reamed to oversize.

Service valves are available in standard (.343") and +.003", +.006", +.013" sizes. If clearance is found to be excessive as described above, guide should be reamed to the next oversize using the appropriate reamer, and a valve having a corresponding oversize stem should be installed.

The following tools are recommended for the reaming operation:

Size	Tool Number
+.003" (.346")	J-5830-1
+.006" (.349")	J-5830-6
+.013" (.356")	J-5830-7

Valves with a .003" oversize diameter and .003" oversize valve guides are installed at the factory on some engines. Engines so fitted will be marked by a "3" stamped on the cylinder head gasket surface in line with the oversize valve.

All oversize service valves will be so marked on the valve head so that they may be easily identified when part numbers are not available.

When an oversize valve is installed, be sure to stamp the oversize marking on the cylinder head gasket surface, as explained above, for future reference.

Check concentricity of all valve seats. This should be within .004 inch total, as measured with dial indicator and a solid, slightly tapered pilot which has a slight bind in the valve guide when installed.

CAUTION: A pilot of the correct size must be used. Do not attempt to drive pilot into guide. Pilots with adjustable diameters to fit various sized guides are not recommended as valve guide damage could result.

Grind valve seats to within .002 inch indicator reading when new valves are being installed, or if concentricity, seat width, or full contact of valves is not as specified.

Check seat width and location on valve to insure proper heat dissipation and prevent build up of carbon on seats. Condition valve seat to a width of 3/64 to 1/16 inch. This seat width will insure good idle stability.

Valve seats should be cut on a 45° angle so that the seat is 1/16 inch smaller in diameter than the valve head, Fig. 6-140, to allow heat to escape and to provide maximum life for newly ground valves. The diameter of the seat can be checked by placing valve in position and then rotating to get a contact pattern with the seat.

New valves have a face angle of 44° to provide a line contact between the head of the valve and the valve seat in the cylinder head, which assures good seating of the valve and less chance of burning the valve head due to exhaust gas leakage. When reconditioning valves, always grind valve face angle to 44°.

Service valves should not have more than 1/16 inch wide contact with valve seats (due to 1° difference in angle) and should not be ground as they are ready to use as received. Grinding of valves by hand with grinding compound or lapping to seat them is not recommended. Use only precision equipment for valve and seat reconditioning, and follow equipment manufacturer's instructions.

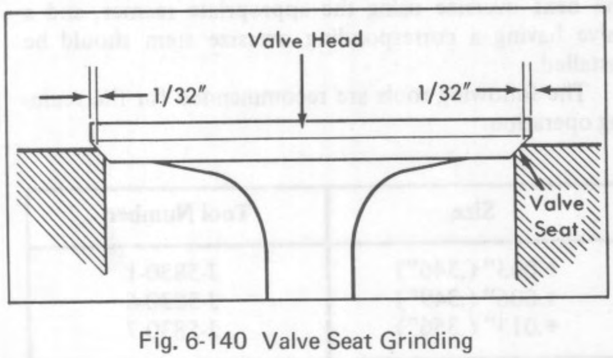


Fig. 6-140 Valve Seat Grinding

112. Engine Oil Pan

a. Removal

1. On Eldorados, drain oil, remove engine from vehicle chassis as described in Note 98, and proceed with Steps 9 and 10.
2. Disconnect negative battery cable.
3. Raise car on hoist.
4. Drain engine oil.
5. Remove exhaust "Y" pipe at exhaust manifold as described in Section 8, Note 11a.
6. Remove starter motor as described in Note 26a.
7. Remove two idler arm support mounting screws and lockwashers from frame side member, and lower support.
8. Disconnect pitman arm at center link, using Puller, J-8990, and lower steering linkage.
9. Remove transmission lower cover.
10. Remove nuts and cap screws that hold oil pan to cylinder block and remove oil pan.
11. Remove side gaskets and rubber front and rear seals from oil pan, and discard.

b. Installation

1. Cement new gasket to both sides of oil pan, with gasket cement lining up holes in gaskets with holes in oil pan flange.
2. Thoroughly clean front and rear seal surfaces of oil pan, and install new oil pan front and rear seals by pulling locating tangs on seals through locating holes in seal flange. Make sure seals are firmly positioned on flange surfaces with ends of each seal properly located in cut-out notches in side gaskets.
3. Seal all four corner notch openings with a coating of gasket cement.
4. Clean out notches in block where ends of oil pan rear seal fit. Fill this rectangular cavity with Transmission Cooler Hose Cement.

   (NOTE: This cement will be easier to apply if the tube has been stored in a cool location to prevent the contents from becoming too thin.)

5. Position oil pan on bottom surface of cylinder block and install cap screws and nuts tightening to 10 foot-pounds.
6. On Eldorados, install engine as described in Note 98b and proceed with Step 12.
7. Install transmission lower cover and secure with four cap screws. Tighten screws to 20 foot-pounds.
8. Connect pitman arm to center link.
9. Secure idler arm support mount to frame with two attaching screws and lockwashers. Tighten screws to 35 foot-pounds.
10. Secure starter motor to cylinder block as described in Note 26b.
11. Install exhaust "Y" pipe as described in Section 8, Note 11b.
12. Lower car.
13. Add four quarts engine oil to crankcase. Use five quarts on Eldorado. Check oil dipstick for proper oil level.

14. Connect negative battery cable.
15. Run engine and check for leaks at all connections.

113. Oil Pump Servicing

a. Removal

1. Raise car.
2. Remove oil filter.
3. Remove five screws securing oil pump to engine, Fig. 6-141. The screw nearest the pressure regulator should be removed last, allowing the pump to come down with screw. Discard oil pump to crankcase gasket.
4. Remove pump drive shaft.

b. Disassembly

1. Slide drive shaft, drive gear, and driven gear out of pump housing.
2. Using a 5/16 inch hex head wrench, remove plug from pump housing assembly, and remove oil pressure regulator valve and spring from bore in housing assembly.

c. Inspection

1. Inspect oil pressure regulator valve for nicks and burrs that might cause a leak or binding condition in bore of pump housing.
2. Check free length of regulator valve spring. It should be approximately 2.57 inches to 2.69 inches in length. A force of 7-1/2 to 8-1/2 pounds should be required to compress the spring to 1-7/16 inches.
3. Inspect drive gear and driven gear for nicks and burrs.
4. Inspect pump housing for wear and score marks.
5. Check pump mating surfaces on engine block for wear and score marks.

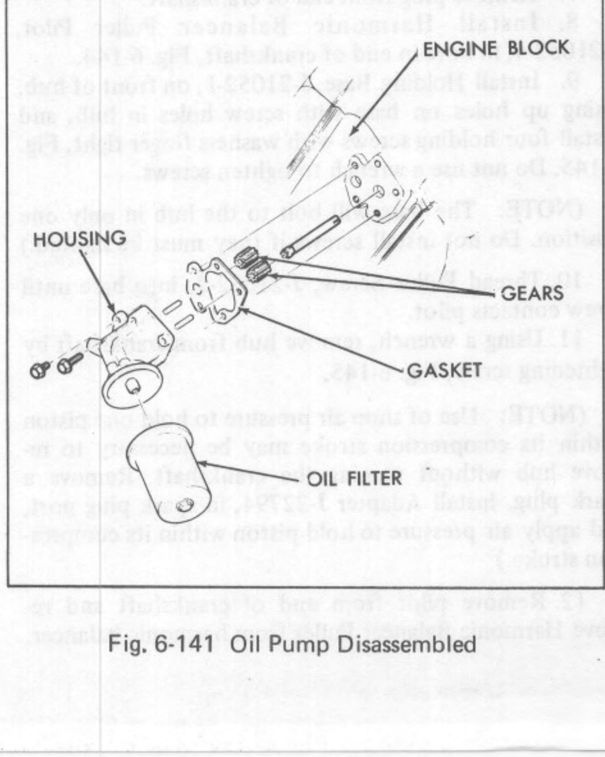


Fig. 6-141 Oil Pump Disassembled

d. Assembly

1. Install oil pressure regulator valve and spring in bore of pump housing assembly.
2. Using a 5/16 inch hex head wrench, install plug in housing assembly and tighten plug to 30 foot-pounds.
3. Install pump drive gear over lower shaft in pump housing.
4. Slide driven gear over remaining shaft in pump housing, meshing driven gear with drive gear.

(NOTE: The hex markings on both gears should be installed upwards toward the crankcase.)

e. Installation

1. Pack pump with petrolatum.
2. Position new gasket on pump housing.
3. Engage pump drive shaft with distributor drive and guide into oil pump drive gear.
4. Install pump to engine by allowing it to ride up as screw nearest pressure regulator is turned in.
5. Install remaining four screws. Tighten all five screws to 15 foot-pounds.
6. Install oil filter and add 1 quart engine oil to crankcase.
7. Run engine (oil pressure light should go out) and check for leaks in pump area.
8. Lower car.

114. Rear Main Bearing Oil Seal Replacement

Rear main bearing seal installation can be properly accomplished by using a simple, easily made tool, Fig. 6-142. Make the tool out of a metal banding strap or shim stock. The tool will act as a "shoehorn" to protect the backbone or outer diameter of the seal from scraping against the sharp edge of the cylinder block. Replacement procedure is as follows:

1. Disconnect spark plug wires and remove spark plugs.
2. Raise car.
3. Remove oil pan as described in Note 112a.
4. Loosen two screws that hold rear main bearing cap to cylinder block and remove cap with screws.
5. Remove lower seal half from bearing cap and discard.

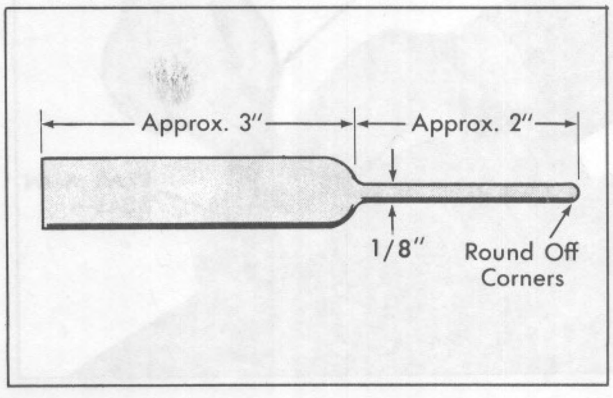


Fig. 6-142 Main Bearing Oil Seal Tool

6. Rotate upper seal half by pushing on one end with sharp object, and remove upper seal half from cylinder block.

7. Inspect grooves in bearing cap and cylinder block to be sure they are clean, dry, and free from burrs.

(NOTE: The two seal halves are identical and can be used in either the lower or upper location. Both seal halves are pre-lubricated with a film of wax for break-in. Do not remove or damage this film.)

8. To install lower half of seal into the bearing cap, slide either end of seal into position at one end of bearing cap and place tool in groove at other end of bearing, Fig. 6-143. Make sure the seal is positioned in the groove and the lip of the seal is facing forward (car position).

9. Hold thumb or finger over end of seal that is flush with split line to prevent it from slipping upward, and push seal into seated position by applying pressure to the other end.

10. Make sure seal is pressed down firmly and is flush on each side to avoid possibility of a leak at the seal split line. Avoid pressing on lip as damage to sealing edge could result.

11. To install upper half of seal in cylinder block (with crankshaft in car), position "shoehorn" in groove of block. Lubricate seal and start into groove in block with lip facing forward. Rotate seal into position, using care not to distort it, Fig. 6-143.

12. Do not press on lip or sealing edge of seal may be damaged. Also, both ends of seal should be flush at the seal split line to avoid leaks.

13. If necessary, Lubriplate, or its equivalent, may be used to facilitate installation of both lower and upper half of seal. Do not use silicone or an oil leak may result.

14. Install bearing cap and secure with attaching screws. Tighten screws to 95 foot-pounds.

15. Rotate crankshaft 360° to make sure crankshaft is not binding.

16. Install oil pan as described in Note 112b.

17. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires.

18. Run engine and check for oil leaks.

19. Lower car.

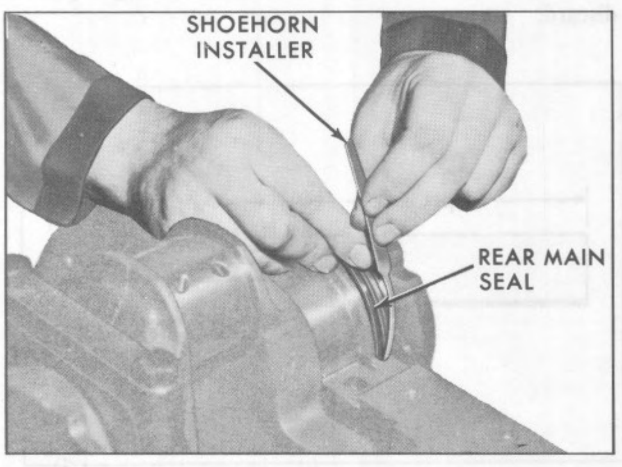


Fig. 6-143 Installing Rear Main Oil Seal

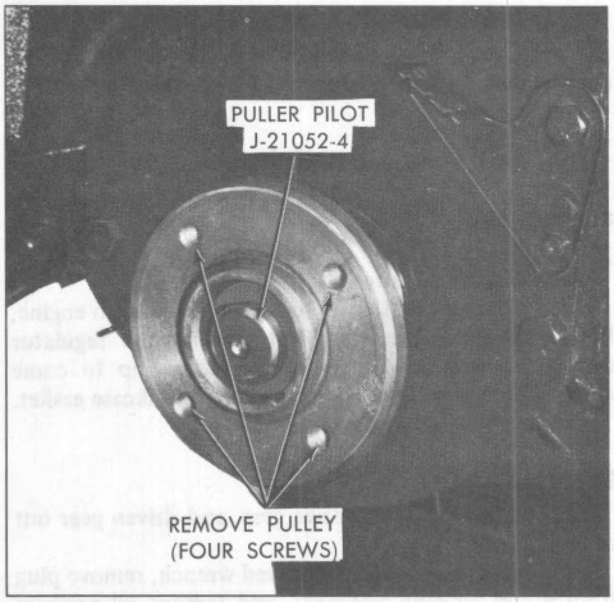


Fig. 6-144 Installing Balancer Hub Pilot

115. Harmonic Balancer

a. Removal

1. Disconnect negative battery cable.

2. Drain coolant from radiator.

3. Loosen hose clamp at radiator inlet (top) and remove one screw securing hose to radiator cover. Position upper radiator hose out of way.

4. Remove fan blade assembly as described in Note 7a or 7b.

5. Remove generator belt and power steering pump belt.

6. Remove four cap screws that hold crankshaft pulley to harmonic balancer and remove pulley and balancer.

7. Remove plug from end of crankshaft.

8. Install Harmonic Balancer Puller Pilot, J-21052-4, in bore in end of crankshaft, Fig. 6-144.

9. Install Holding Base, J-21052-1, on front of hub, lining up holes on base with screw holes in hub, and install four holding screws with washers finger tight, Fig. 6-145. Do not use a wrench to tighten screws.

(NOTE: The base will bolt to the hub in only one position. Do not install screws if they must be slanted.)

10. Thread Puller Screw, J-21052-2, into base until screw contacts pilot.

11. Using a wrench, remove hub from crankshaft by tightening screw, Fig. 6-145.

(NOTE: Use of shop air pressure to hold one piston within its compression stroke may be necessary to remove hub without turning the crankshaft. Remove a spark plug, install Adapter J-22794, in spark plug port, and apply air pressure to hold piston within its compression stroke.)

12. Remove pilot from end of crankshaft and remove Harmonic Balancer Puller from harmonic balancer.

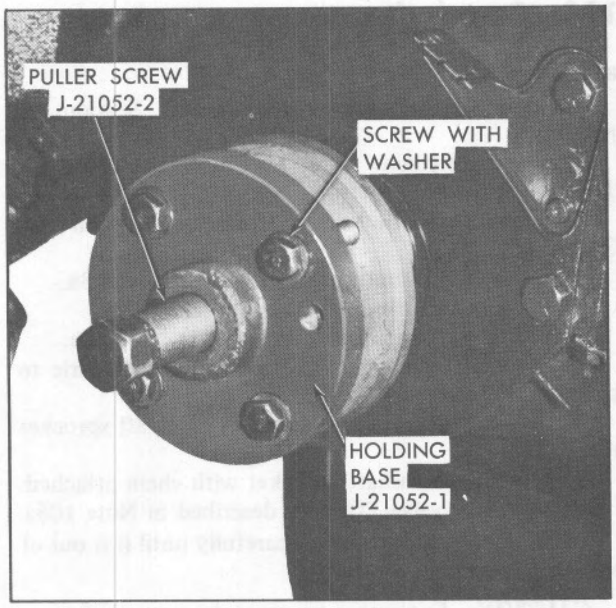


Fig. 6-145 Removing Balancer Hub Pilot

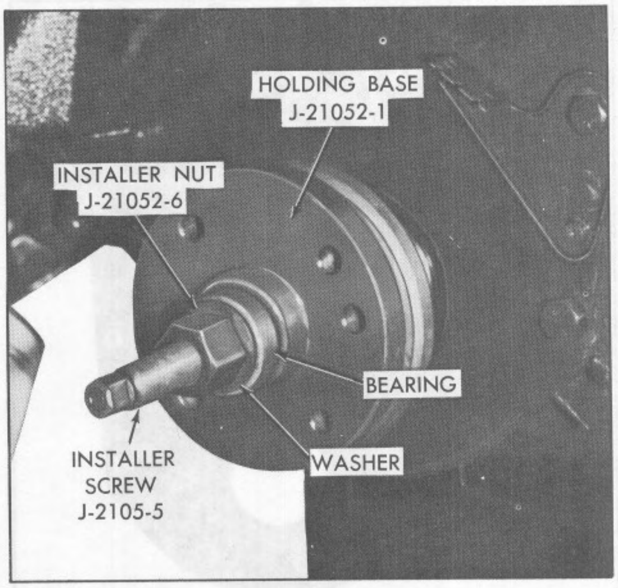


Fig. 6-146 Installing Balancer Hub

b. Installation

1. Lubricate bore of hub and seal with E.P. lubricant to prevent seizure to crankshaft.
2. Position hub on crankshaft, lining up to key slot in hub with key on crankshaft.
3. Place Holding Base, J-21052-1, against front face of pulley and thread Installer Screw, J-21052-5, into end of crankshaft. Position thrust bearing with inner race forward, washer next, and Installer Nut, J-21052-6, last, Fig. 6-146.
4. Using a wrench, install hub on crankshaft by tightening screw.

(NOTE: Use of shop air pressure, as explained in removal procedure, may be necessary to install hub assembly without turning crankshaft.)

5. When harmonic balancer assembly is positioned on crankshaft, remove Harmonic Balancer Remover and Installer. Do not try to install harmonic balancer all the way with this tool, or tool will be damaged. Thread a 1962 harmonic balancer-to-crankshaft screw and washer in end of crankshaft. Tighten screw to 125 foot-pounds.
6. Install four pulley to harmonic balancer screws that were previously removed and tighten all four screws to 15 foot-pounds.

(NOTE: Hole in balancer and hub will line up only in one position.)

7. Remove screw and washer from end of crankshaft, and install plug.
8. Exhaust air pressure from cylinder, remove Adapter, J-22794, and install spark plug.
9. Install pulley and fan blade assembly on water pump as described in Note 7b or 8b.
10. Install power steering pump belt and generator drive belt on pulleys.
11. Adjust all belts as described in Note 10.
12. Connect upper radiator hose at radiator inlet pipe and secure with hose clamp. Secure hose to radiator cover with one screw.
13. Lower car.
14. Refill cooling system with coolant.
15. Reconnect negative battery cable.
16. Run engine to check for coolant and oil leaks.

116. Engine Front Cover

a. Removal

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 98a.
2. Remove harmonic balancer as described in Note 115a.
3. Loosen starter sufficiently to gain access to oil pan screws.
4. Loosen oil pan nuts and screws and lower front of oil pan.
5. Loosen hose clamp at water pump inlet and remove lower radiator hose from water pump.
6. Remove 10 screws that hold front cover to cylinder block and remove cover with water pump attached. Discard gasket.

b. Installation

1. Position new front cover gasket over locating dowels on cylinder block.

(NOTE: Apply a small amount of gasket cement to hold gasket in place.)

2. Install front cover, with water pump attached, over end of crankshaft, lining up dowel holes in cover with locating dowels on cylinder block. Secure with attaching screws. Refer to Fig. 6-147 for proper screw location and torque specifications.
3. Install harmonic balancer as described in Note 115b.

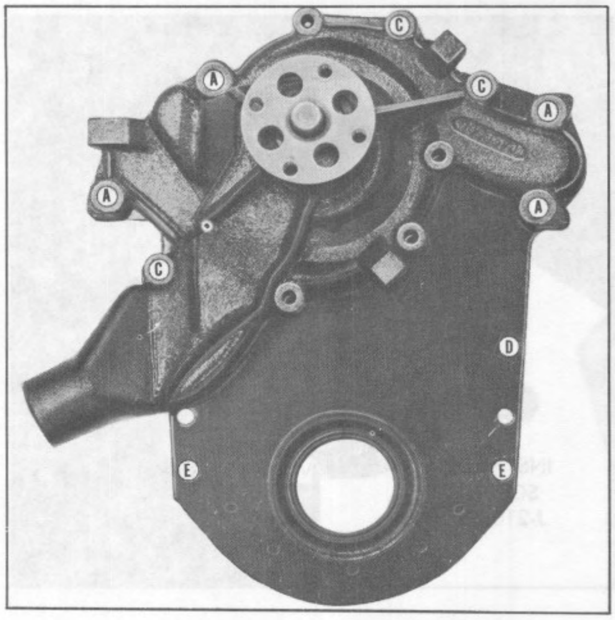


Fig. 6-147 Engine Front Cover Attaching Screws

Key	(No.)	Size	Torque
A	(4)	3/8-16 x 1-3/8	22 Foot-Pounds
C	(3)	5/16-18 x 1-1/4	10 Foot-Pounds
D	(1)	5/16-18 x 5/8	10 Foot-Pounds
E	(2)	3/8-16 x 5/8	22 Foot-Pounds

4. Tighten oil pan nuts and screws to 10 ft. lbs. and tighten starter motor mounting screws to 45 ft. lbs.
5. If working on Eldorado, install engine in vehicle chassis as described in Note 98b.
6. Install lower radiator hose to water pump inlet and secure with hose clamp.
7. Refill cooling system and engine as described in Note 5 and Section 0, Note 2, respectively.
8. Run engine and check for leaks.

117. Front Cover Oil Seal Replacement (Fig. 6-148)

a. Removal

1. Remove harmonic balancer as described in Note 115a.
2. With thin-bladed screwdriver or similar tool, pry out front cover oil seal. Discard seal.

b. Installation

1. Lubricate new oil seal by filling the cavity between the lips with wheel bearing grease. Position seal on end of crankshaft with garter spring side toward engine.
2. Using Seal Installer, J-22770, and hammer, drive seal into front cover until it bottoms against front cover, Fig. 6-148.
3. Install harmonic balancer as described in Note 110b.

118. Camshaft

a. Removal

1. Remove radiator as described in Section 13, Note 1a.
2. Remove engine front cover as described in Note 116a.
3. Remove ignition distributor as described in Note 31a or 42a.
4. Remove oil pump as described in Note 113a.
5. Remove oil slinger from crankshaft.
6. Remove fuel pump as described in Note 82a.
7. Remove screw securing fuel pump eccentric to camshaft and remove eccentric.
8. Remove two screws securing camshaft sprocket to camshaft.
9. Remove camshaft sprocket with chain attached.
10. Remove valve lifters as described in Note 106a.
11. Slide camshaft forward carefully until it is out of engine.

CAUTION: Extreme care must be exercised to keep cam lobes from scratching camshaft bearings.

b. Inspection

The camshaft is made of alloy cast iron. It must be handled with particular care to avoid damage.

Whenever camshaft has been removed from engine, or faulty camshaft action is suspected in diagnosing engine conditions, the camshaft lobes should be visually checked for wear. This may be done with camshaft installed in engine by removing hydraulic lifters and noting condition of camshaft lobes. Excessive wear, scoring, or flaking of the lifter will usually denote camshaft wear. Excessive camshaft wear is evidenced by grooves, scoring, or flaking. Camshaft should be replaced if any of these conditions exist.

Fig. 6-148 Installing Front Cover Oil Seal

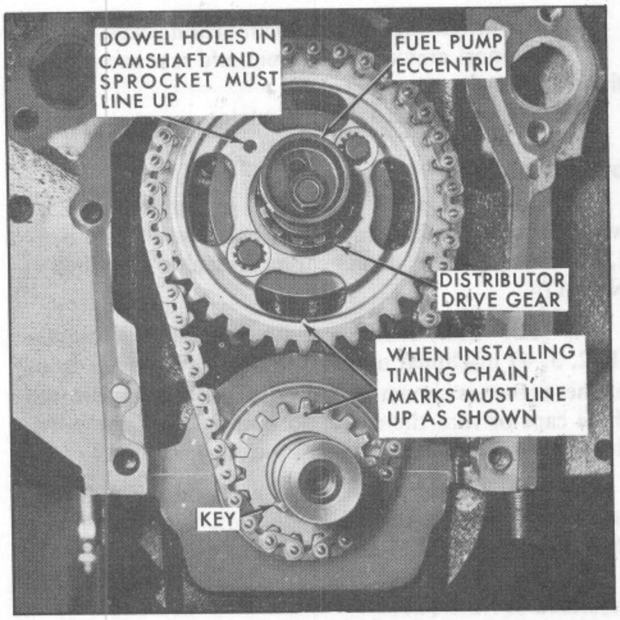


Fig. 6-149 Timing Sprockets

Bearing journals should not be scored or burned. Camshaft bearings should be visually inspected in their bores for excessive wear.

c. Installation

1. Apply a thin coat of rear axle lubricant to all camshaft lobes and bearing journals.
2. Guide camshaft carefully into cylinder block.

CAUTION: Extreme care must be exercised to avoid nicking or scratching camshaft bearings.

3. Install valve lifters as described in Note 106b.
4. Install camshaft sprocket in timing chain with timing mark toward front.
5. Place chain over crankshaft sprocket and line up timing marks on both sprockets, Fig. 6-149.

(NOTE: Engine is being timed so that cylinder #4 is in the firing position.)

6. Hold camshaft sprocket in position against end of camshaft and press sprocket on camshaft by hand, being sure index hole in camshaft is lined up with index hole in sprocket.
7. Install two screws and lockwashers securing camshaft sprocket to camshaft. Tighten screws to 18 foot-pounds.
8. Install fuel pump eccentric on camshaft and secure with screw. Tighten screw to 35 foot-pounds.
9. Install fuel pump as described in Note 82b.
10. Install oil slinger on crankshaft with smaller end of slinger against crankshaft sprocket.
11. Install engine front cover as described in Note 116b.
12. Install ignition distributor as described in Note 31b or 42b.

(NOTE: Engine timing has been set so that cylinder #4 is in the firing position. When installing the distributor, either set the rotor so that cylinder #4 is firing or crank the engine 360° as observed at crankshaft and set ignition timing on cylinder #1.)

13. Install oil pump as described in Note 113b.
14. Install radiator as described in Section 13, Note 1b.

119. Camshaft Bearing Replacement

Babbitt type camshaft bearings are used on all engines. Whenever camshaft has been removed from engine for inspection, these bearings should be visually inspected in their bores for excessive wear. If excessive wear is evident, all five bearings should be replaced. A precision pre-machined camshaft bearing, interchangeable bore to bore, is available for field replacement.

a. Removal

1. Remove camshaft as described in Note 118a.
2. Thread Arbor, J-21054-2 on end of Drive Shaft, J-21054-1, and position shoulder on arbor against front face of No. 1 bearing, Fig. 6-150.
3. Using a hammer, drive out No. 1 bearing through rear face of bearing bore. Remove bearing from arbor and discard.
4. Remove remaining four bearings in same manner. When removing No. 5 bearing, drive out rear cup plug, located behind No. 5 bearing, along with bearing.

b. Installation

1. Install new cup plug in rear of No. 5 bearing bore and seal plug with a permanent type sealer.
2. Locate center oil passage in each bearing bore and scribe a reference mark on front face of each bore, Fig. 6-151.
3. Slide Drive Shaft, J-21054-1, with Arbor, J-21054-2, through No. 1, 2, 3, and 4 bearing bores until arbor is positioned between No. 4 and No. 5 bores.
4. Place new bearing on Arbor and position in No. 5 bearing bore, lining up oil hole in bearing with scribe mark on front face of bore, Fig. 6-152.
5. Using a hammer, install bearing in bore until oil hole in bearing is lined up with oil passage in bore.
6. Install No. 4, 3, 2, and 1 bearings in the same manner.
7. Install camshaft as described in Note 118b.

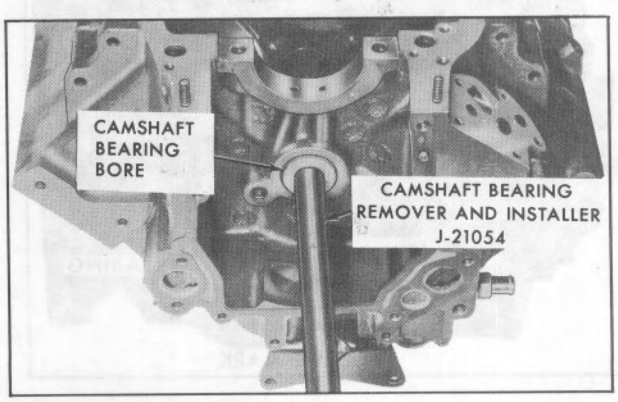


Fig. 6-150 Removing Camshaft Bearings

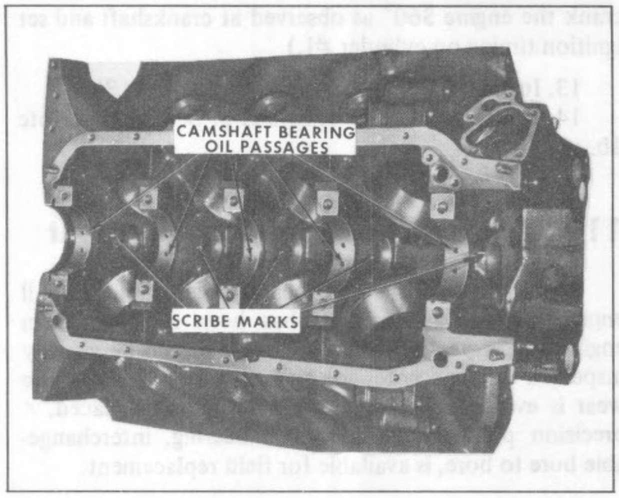


Fig. 6-151 Camshaft Bearing Oil Passages

120. Crankshaft

a. Removal

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 98a. Proceed to Step 3.
2. Raise car.
3. Remove oil pan as described in Note 112a.
4. Remove timing chain and sprockets as described in Note 118a Steps 1 through 8.
5. Remove screws and nut securing oil pick-up tube and strainer assembly to cylinder block and remove intake screen assembly. Discard O-ring.
6. On all cars except Eldorado remove transmission as described in Section 7, Note 12.
7. Remove six screws that hold flywheel to crankshaft and remove flywheel.
8. Remove spark plugs.
9. Disconnect connecting rods and, using Connecting Rod Guide Set, J-3224, to protect journals, push pistons up into cylinders so that crankshaft can be removed without interference.

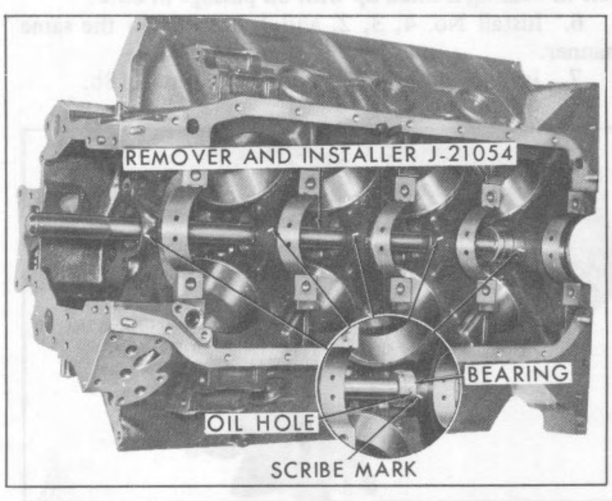


Fig. 6-152 Installing Camshaft Bearings

10. Remove front and rear main bearing caps.
11. Support crankshaft at front and rear and remove three intermediate bearing caps.
12. Remove crankshaft from engine.

b. Installation

1. Place crankshaft in position and support in place while installing main bearing caps as described in Note 128. Use a new rear main bearing oil seal as described in Note 114.

(NOTE: Each bearing cap has a number of dimples (1, 2, 3, 4) machined on bottom starting from the front of the engine as shown in Fig. 6-153. Do not mismatch these caps or turn them around because they are individually matched as the cylinder block is machined.)

2. Lubricate crankpins with engine oil and pull connecting rods down toward crankshaft. Use Connecting Rod Guide Set, J-3224, to protect journals.
3. Install connecting rods on crankshaft as described in Note 121.
4. Install oil pick-up tube and strainer assembly with new O-ring on cylinder block and secure with two screws and nut. Tighten to 18 foot-pounds.
5. Install flywheel and secure with six screws. Tighten screws to 75 foot-pounds.
6. On all cars except Eldorado, install transmission as described in Section 7, Note 12.
7. Install spark plugs. Tighten to 25 foot-pounds.
8. Install timing chain and sprockets as described in Note 118b.
9. Install oil pan as described in Note 112b.
10. Lower car.
11. If working on Eldorado, install engine in vehicle chassis as described in Note 98b.

121. Connecting Rod and Piston

a. Removal

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 98a.

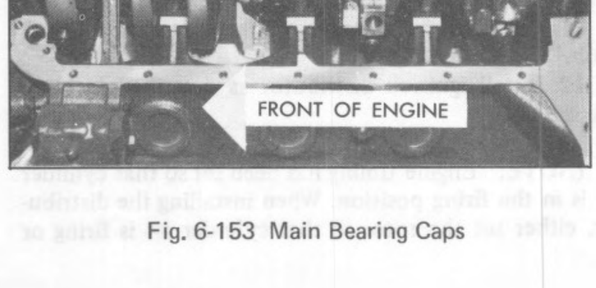


Fig. 6-153 Main Bearing Caps

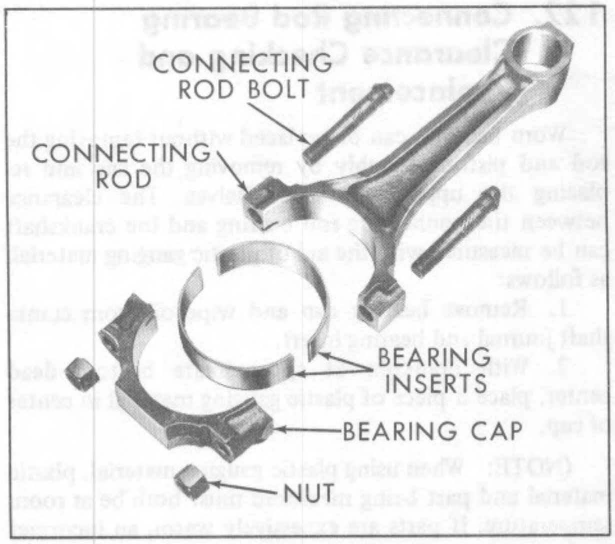


Fig. 6-154 Connecting Rod and Bearing

2. Remove cylinder heads as described in Note 109a.

3. Clean carbon from top of cylinder bore. Ream upper ridges if necessary to prevent breakage or distortion of piston ring lands due to rings catching in the ridge. Pack cylinder bore with cloth to catch shavings.

4. Remove oil pan as described in Note 112a.

5. Remove two cap screws and nut that hold oil pick-up tube and strainer assembly to cylinder block. Discard O-ring.

6. Remove connecting rod cap by removing connecting rod nuts and sliding cap down off connecting rod bolts, Fig. 6-154.

7. Install Connecting Rod Guide Set, J-3224, on connecting rod bolts.

CAUTION: Be careful not to damage crankshaft or cylinder bore when removing piston and rod assembly.

8. Push connecting rod and piston assembly up until piston rings are out of bore, and remove piston and connecting rod assembly from engine.

CAUTION: Be careful not to nick lower edge of bore when pushing rod up.

9. Remove remaining seven piston and connecting rod assemblies in same manner.

b. Installation

(NOTE: Refer to Note 125 for piston identification between 472 and 500 cubic inch engines.)

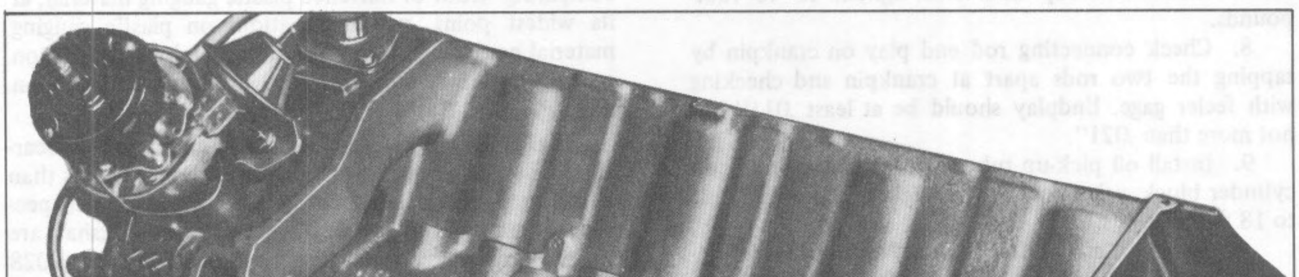


Fig. 6-155 Engine Partially Disassembled

1. Removing connecting rod cap from connecting rod and install bearing inserts in both cap and rod, being careful to locate bearing tangs in locating notches.

2. Install Connecting Rod Guide Set, J-3224, on rod bolts to protect crankpin journals.

3. Using Piston Ring Compressor, J-22748, position capless rod and piston in cylinder bore with notch toward front of engine (letter "R" on piston toward rear) as shown in Fig. 6-155.

4. Using wood hammer handle, tap piston and connecting rod down into position on crankpin, Fig. 6-156, and remove Connecting Rod Guide Set, J-3224.

CAUTION: Extreme care must be exercised when installing pistons and rods to be sure rod is lined up with crankshaft journals and does not stick or bind on counterweights.

5. Install connecting rod cap with bearing in place over connecting rod bolts, making sure numbered side of cap is on same side as numbered side of rod.

6. Install remaining seven piston and connecting rod assemblies in the same manner.

(NOTE: Recheck to see that numbered sides of connecting rods on Nos. 1, 3, 5, and 7 rods are on right side of engine and Nos. 2, 4, 6, and 8 are on left side of engine, and that rods are on proper crankpin.)

7. Install rod cap nuts and tighten to 40 foot-pounds.

8. Check connecting rod end play on crankpin by tapping the two rods apart at crankpin and checking with feeler gage. Endplay should be at least .011" but not more than .021".

9. Install oil pick-up tube and strainer assembly on cylinder block, using new O-ring. Tighten screws and nut to 18 foot-pounds.

10. Install oil pan as described in Note 112b.

11. Install cylinder heads as described in Note 109b.

12. If working on Eldorado, install engine in vehicle chassis as described in Note 98b.

Fig. 6-156 Installing Piston in Cylinder Block

122. Connecting Rod Bearing Clearance Checking and Replacement

Worn bearings can be replaced without removing the rod and piston assembly by removing the cap and replacing the upper and lower halves. The clearance between the connecting rod bearing and the crankshaft can be measured with the aid of plastic gauging material, as follows:

1. Remove bearing cap and wipe oil from crankshaft journal and bearing insert.

2. With crankpin at approximate bottom dead center, place a piece of plastic gauging material in center of cap.

(NOTE: When using plastic gauging material, plastic material and part being measured must both be at room temperature. If parts are excessively warm, an incorrect reading may result. Fresh plastic gauging material is recommended for greatest accuracy.)

3. Reinstall bearing cap. Tighten screws to 40 foot-pounds.

(NOTE: It is extremely important to position tangs on bearings in notches in rod and cap.)

4. Remove bearing cap and determine clearance by comparing width of flattened plastic gauging material, at its widest point, with graduations on plastic gauging material container. Number within matching graduation on envelope indicates clearance in thousandths of an inch. Fig. 6-157.

If clearance is greater than .0035 inch, replace bearing. If new bearings do not reduce clearance to less than .0035 inch, crankshaft must be replaced to obtain specified limits. If both new bearings and new crankshaft are installed, clearance should be from .0005 inch to .0028 inch.

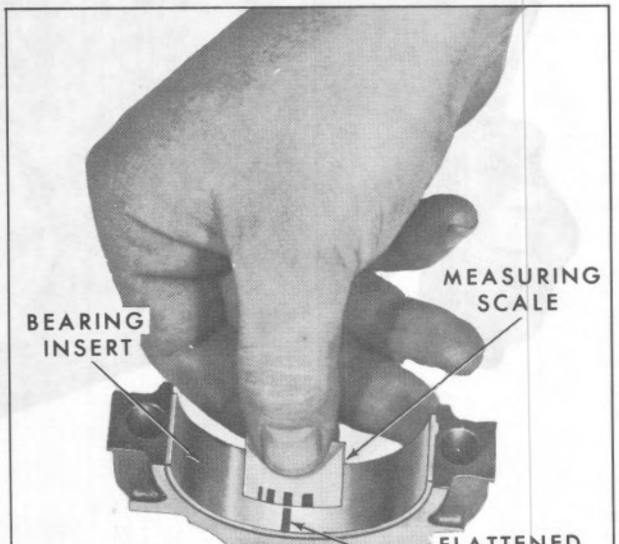


Fig. 6-157 Checking Bearing Clearance

123. Piston Ring Replacement

Each piston has two compression rings and a side-seal type oil ring that incorporates a steel expander and two identical chrome plated steel rails. The top compression ring is molybdenum filled cast iron. The second compression ring is coated cast iron.

When replacing piston rings, install only re-ring sets that have molybdenum filler upper compression ring, and multi-piece oil rings.

The compression rings are chamfered on the lower inner face. There is a locating "dimple" on both rings near the end for easy identification on the top side. Install with top side "dimple" facing up.

1. Place ring in area of cylinder where piston ring will travel. Be sure ring is square with cylinder bore by positioning ring with piston head.
2. Gap between compression ring ends should be .013 inch to .025 inch.
3. Gap between oil ring ends should be .015 inch to .055 inch.
4. With compression ring on piston, clearance between top surface of piston ring and ring land should be no greater than .005 inch. If clearance is greater, replace the ring. If the new ring does not reduce the clearance to .005 inch or less, new pistons should also be installed.

Clearance on new rings and new pistons should be .0017 inch to .0040 inch. This can be checked with a .0015 inch and .005 inch feeler gage on a "go-no-go" basis. The .0015 inch feeler gage should always enter; the .005 inch feeler gage should never enter. When installing rings on piston, gaps in piston rings should be staggered by approximately 120°.

124. Piston Pin

a. Removal

1. Place Piston Pin Support, J-8390-8, on arbor press.
2. Insert Piston Pin Pilot, J-8390-9, in piston pin on side opposite letter "R" on piston.
3. Position piston and connecting rod assembly on support with side of piston marked with the letter "R" upward, Fig. 6-158.
4. Insert pilot end of Piston Pin Remover and Installer, J-8390-6, into piston pin and press pin out of piston and rod assembly.
5. Remove assembly from press and remove piston from support.

(NOTE: Keep piston pins in order so that they can be installed in the piston from which they were removed.)

b. Installation

1. Lubricate piston pin and pin holes in piston with engine oil to facilitate installation.
2. Place Piston Pin Support, J-8390-8, on arbor press with Spring, J-8390-4, and Spacer, J-8390-2, with open end over spring in position in Support, Fig. 6-159.
3. Position connecting rod in its respective piston so that, when assembly is installed in engine, side of piston stamped with the letter "R" is toward rear of the engine and number on lower end of rod is down (Numbers 1, 3, 5, and 7 are in the right bank and 2, 4, 6, and 8 are in the left bank).
4. Position piston with connecting rod on Piston Pin Support, and insert piston pin into position as shown in Fig. 6-159.
5. Place Piston Pin Remover and Installer, J-8390-6, on piston pin and press pin until it bottoms on spacer in support. Remove piston and connecting rod from support. Center pin in piston, this will properly locate the connecting rod on the piston pin and piston.

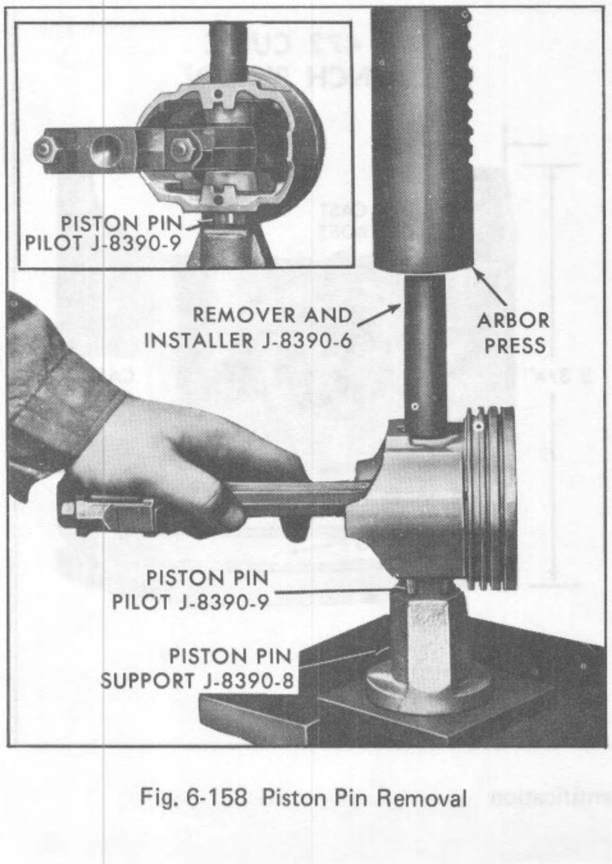


Fig. 6-158 Piston Pin Removal

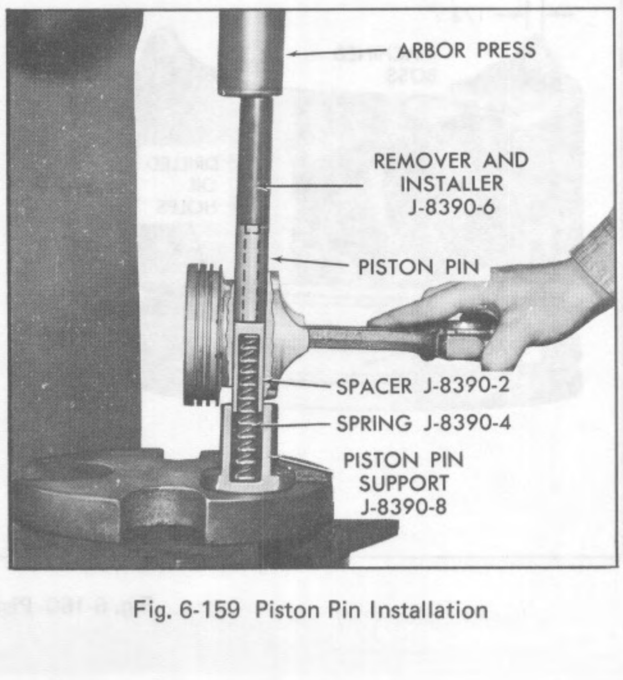


Fig. 6-159 Piston Pin Installation

(NOTE: Piston pins are a selective fit to the piston and are not available separately. Piston pins will not normally wear enough to cause a knock or tapping; however in cases where wear is abnormal, a new piston and pin assembly should be installed.)

125. Piston Identification

Engines are available with two different displacements. The Eldorado uses a 500 cubic inch engine, while all other cars utilize a 472 cubic inch engine. Since both engines are of the same design and have an identical 4.300" bore size, it is important to install the correct piston for the engine being worked on. Pistons for both engines are shown in Fig. 6-160.

(NOTE: Dimensions shown in Fig. 6-160 are for comparison purposes only and therefore not exact.)

126. Piston Clearance

When measuring piston diameter, the micrometer should be placed 3/16 inch below the cross slot or 1/4 inch below the oil ring groove, Fig. 6-161. Cylinders must be measured by placing the micrometer 1-1/8 inches from the top, and perpendicular to the centerline of the face.

An identification letter is stamped on the cylinder head face of the cylinder block. The letter is located directly below the cylinder bore. This letter denotes the cylinder-piston size as shown in the following table:

Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.3000 - 4.3002	4.2992 - 4.2994
B	4.3002 - 4.3004	4.2994 - 4.2996
C	4.3004 - 4.3006	4.2996 - 4.2998
D	4.3006 - 4.3008	4.2998 - 4.3000
E	4.3008 - 4.3010	4.3000 - 4.3002
H	4.3010 - 4.3012	4.3002 - 4.3004
J	4.3012 - 4.3014	4.3004 - 4.3006
K	4.3014 - 4.3016	4.3006 - 4.3008
L	4.3016 - 4.3018	4.3008 - 4.3010
M	4.3018 - 4.3020	4.3010 - 4.3012

The table indicates ten piston sizes ranging in steps of .0002 inch from 4.2992 inches to 4.3012 inches. This makes it possible to maintain the .0006 to .0010 inch piston to cylinder wall clearance. The sizes shown apply at 70°F.

If double letters (such as AA, BB) appear on the cylinder head face of the block just above the cylinder bore, it indicates that this particular cylinder has been bored to .010 inch over the diameter indicated by a single letter in the chart. For example, a cylinder with the letters CC stamped on the block would have a diameter of 4.3104 inches to 4.3106 inches; a matching piston for this size would have a diameter of 4.3096 inches to 4.3098.

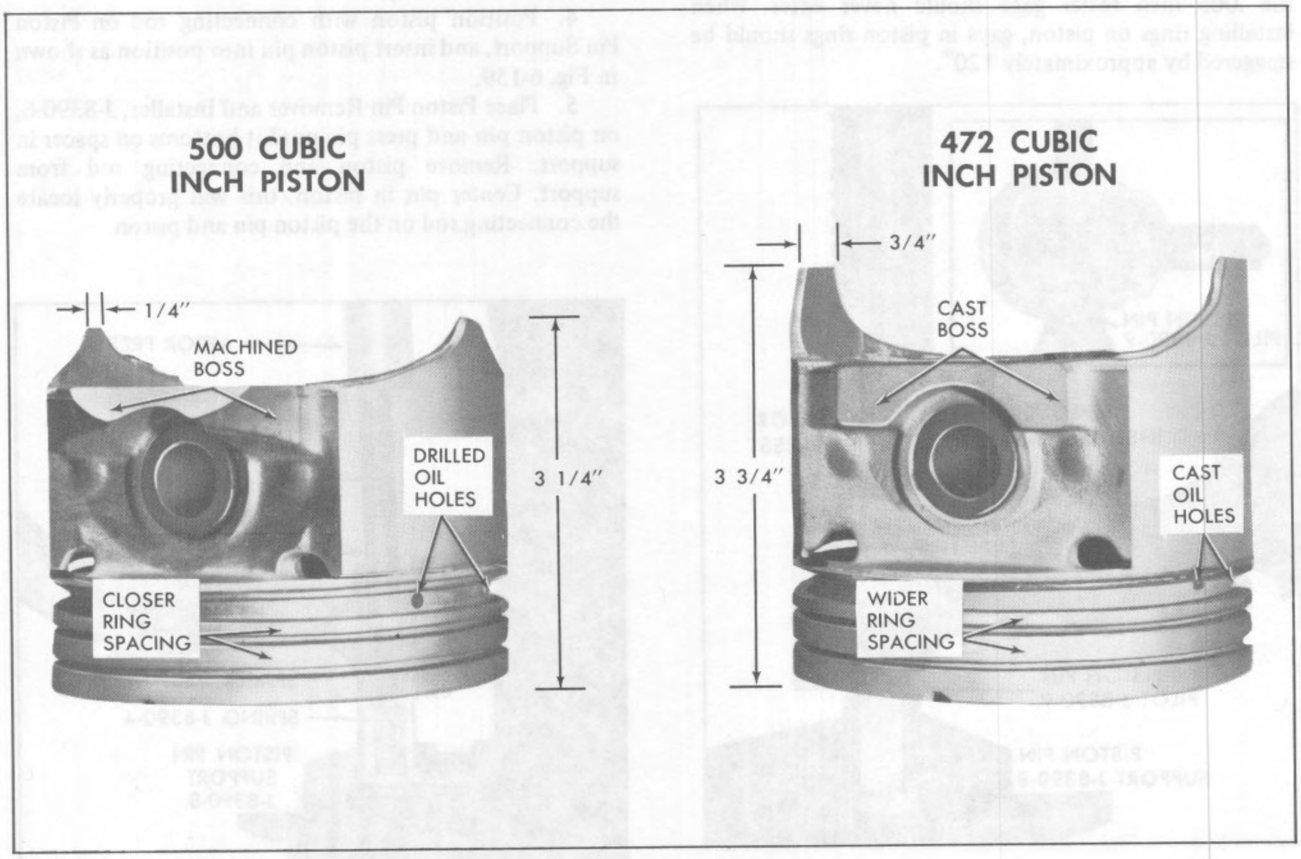


Fig. 6-160 Piston Identification

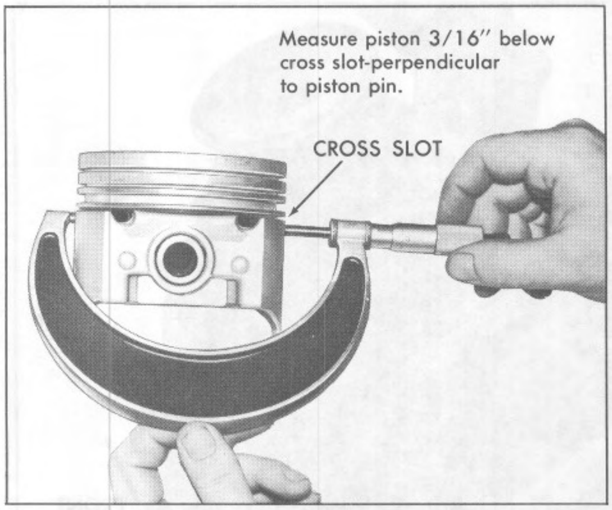


Fig. 6-161 Measuring Piston Diameter

Orders for service pistons will be filled in sizes C, E, J, or L and HH, JJ, or KK through the servicing parts warehouses.

Cylinder bores must not be reconditioned to more than .0100 inch oversize as pistons are not available over this range.

While the current model is in production, specific code size pistons A through M and AA through MM are available from the factory Parts Warehouse in Detroit on a special order basis.

(NOTE: Before special ordering specific code size pistons, it is very important to check the sizes of the cylinder bores by actual measurement. Actual measurement at the time of replacement is the only certain way to avoid error in ordering.)

An outside micrometer and an inside micrometer are required to determine piston clearance. The outside micrometer, used for measuring piston diameter, must be adjusted to turn freely so that it can be adjusted up to the piston with a very light turning effort on the screw. If it is adjusted to get a frictional feel over the piston, it will show several tenths of a thousandth smaller than its actual size. With practice, fractional thousandths can be checked accurately.

The inside micrometer for measuring the cylinders may be used with or without an extension handle. It should be adjusted so the screw turns sufficiently tight to retain its setting while checking the cylinder at the different points to be measured.

The direct readings shown on the inside micrometer should not be taken as the cylinder sizes. With one end of the micrometer contacting the cylinder wall and the other being oscillated, adjust the micrometer until it will just slip through the cylinder with a light drag. Remove the micrometer, obtaining the same feel as when measuring the piston.

By this method, even if the two micrometers do not agree in readings, no error will result in arriving at the actual clearance of the piston in the cylinder.

127. Connecting Rod Alignment

Connecting rods are carefully aligned at the factory and it is not necessary to check their alignment in the field. Only in cases of damage will they become misaligned. If this condition does exist, the piston, pin, and rod assembly should be replaced. Do not attempt to straighten connecting rods.

128. Main Bearing Replacement and Clearance Checking

Shell type main bearings of steel-backed aluminum and steel-backed babbitt are used in all engines. Proper location for these bearings is shown in Fig. 6-162. No. 1 upper and lower bearings halves are interchangeable. No. 2 and 4 upper bearing halves are interchangeable. No. 2 and 4 lower bearing halves are interchangeable. No. 3 upper and lower bearing halves are not interchangeable. The crankshaft end thrust is taken by the center main bearing. The worn limit for crankshaft end play is .015 inch.

a. To Check a Main Bearing

1. Remove bearing cap to be checked.
2. Measure bearing wear using the plastic gauging material method as described in Note 122. Bearing cap must be tightened to 90 foot-pounds.

(NOTE: If bearings are being measured with engine in chassis, crankshaft must be supported in order to take up clearance between upper bearing shell and crankshaft. This can be done by removing bearing caps adjacent to bearing being checked, and placing a strip of .005 inch brass shim stock between lower bearing shell and crankshaft bearing journal.)

CAUTION: When reinstalling bearing caps with shims lightly tighten attaching screws to avoid damaging bearing caps.

3. If bearing clearance is greater than .0045 inch, replace bearing.

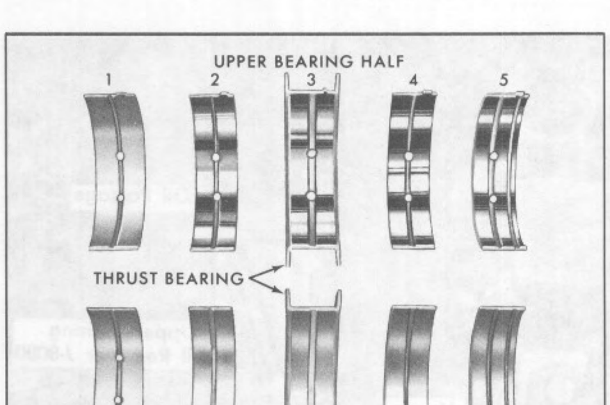


Fig. 6-162 Main Bearing Location

4. If new bearings do not reduce the clearance to less than .0045 inch, crankshaft should be replaced.

If both new bearings and new crankshaft are installed, clearance should be .0003 inch to .0026 inch for all bearings except front bearing. Clearance for front bearing should be .0001 inch to .0024 inch.

b. Main Bearing Replacement

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 98a.
2. Remove spark plugs.
3. Remove engine oil pan as described in Note 112a.
4. Remove two cap screws and nut that hold oil intake screen assembly to cylinder block and remove screen assembly. Discard O-ring.
5. Remove two screws that hold bearing cap to cylinder block and remove cap. Remove worn shell from cap and discard.

(NOTE: Each bearing cap has a number of dimples (1, 2, 3, 4) machined on the bottom starting from the front of the engine, as shown in Fig. 6-153. Do not mismatch these caps or turn them around because they are individually matched when the cylinder block is machined.)

6. Install Upper Bearing Shell Remover, J-8080, into oil hole in crankshaft bearing journal, Fig. 6-163.
7. Slowly rotate crankshaft clockwise (viewed from front of engine) until tool contacts and forces out upper shell.
8. Install new upper shell in place as far as possible by hand, with locating tang in correct position. Remover Tool, J-8080, may also be used to aid in installing new upper shell. Install tool in crankshaft oil passage so that tool bears against notched end of bearing shell. Rotate crankshaft counterclockwise to position bearing, then remove tool, Fig. 6-163.
9. Install new lower shell in cap with locating tang in correct position.

(NOTE: When replacing the rear main bearing, use a new oil seal as described in Note 114.)

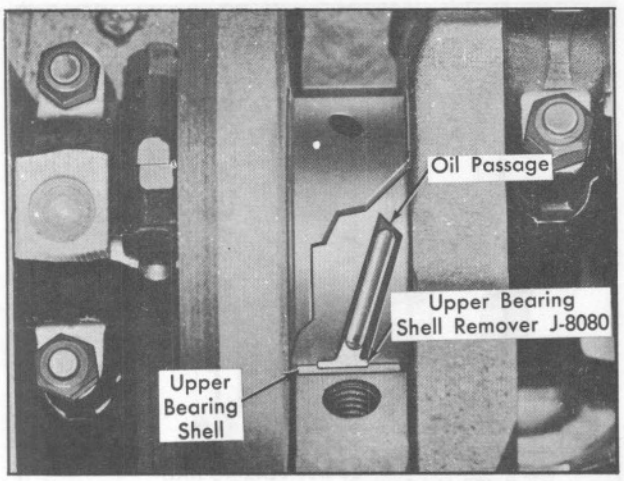


Fig. 6-163 Removing Upper Bearing Shell

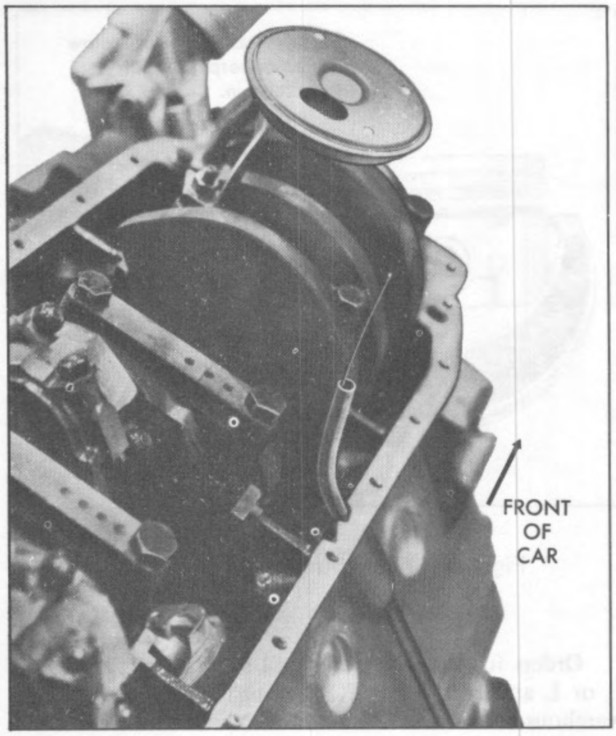


Fig. 6-164 Dipstick Tube Position—Except Eldorado

10. Install cap on cylinder block and secure with two attaching screws. Tighten screws to 90 foot-pounds.
11. Replace four remaining bearings in same manner.

(NOTE: When replacing center bearing it is necessary to line up bearing thrust surfaces. To do this, install bearing cap screws finger tight. Then, using a plastic hammer, tap crankshaft fore and aft the limit of its travel several times. Do not use hammer on connecting rods, tap on counterweights only.)

12. Install oil intake screen assembly on cylinder block using new O-ring, and secure with attaching screws and nut. Tighten to 18 foot-pounds.
13. Install oil pan as described in Note 112b.
14. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires at plugs.
15. If working on Eldorado, install engine in vehicle chassis as described in Note 98b.

129. Dipstick Tube Installation

When replacing engine block and pistons, it is necessary to fit the new assembly with a replacement dipstick tube. To avoid interference with moving parts and to assure proper reading on dipstick when installed, heed the following instructions:

1. Observe dipstick tube holes in left side of engine block. On all cars except the Eldorado, forward hole is for dipstick tube and rear hole should be blocked by a sealing ball. On the Eldorado the reverse is true (i.e., forward hole is blocked, leaving rear hole for tube installation).

2. Line up tube and tap in gently with hammer and block of wood until stop ring on tube contacts block.

3. Install 3/8" tubing bender on dipstick tube:

a. On all cars except the Eldorado, bend tube down and slightly rearward as shown in Fig. 6-164 (another view is given in Fig. 6-163).

b. On the Eldorado, put a shallow rearward bend in the tube so that tube misses No. 3 main bearing cap by 1/2". Tube should point to a spot just forward of center of oil pick up strainer, Fig. 6-165.

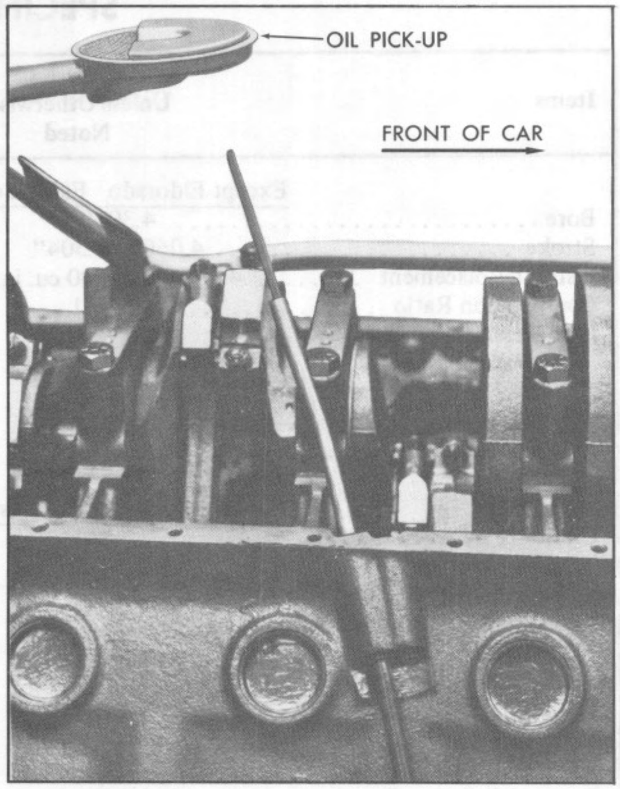


Fig. 6-165 Dipstick Tube Position—Eldorado

SPECIFICATIONS

Items	All Series Unless Otherwise Noted	
	Except Eldorado	Eldorado
Bore	4.300"	
Stroke	4.060"	4.304"
Piston Displacement	472 cu. in.	500 cu. in.
Compression Ratio	8.25 to 1	
Compression Pressure		
At cranking speed (throttle open)	165-185 psi	
At 1000 rpm	212-230 psi	
Points of Suspension	3	
VALVES	Intake	Exhaust
Clearance between stem and guide New limits	.0010"-.0027"	
Worn limits, not over	.005"	
Clearance between lifter body and crankcase	.0005"-.0020"	
Head diameter, overall	2.000"	1.625"
Lift	.457"	.473"
Valve face angle	44°	
Valve seat angle (in head)	45°	
Seat width (in head)	1/16"	
Seat eccentricity, not over (T.I.R.)	.004"	
Stem diameter	.3413"-.3420"	
Valve guide diameter (in head)	.343"	
Rocker Arm Ratio	1.72:1	
VALVE SPRINGS		
Free Length	2.250"	
Pounds required to compress to 1.946" (Valve closed)	60 - 65	
Pounds required to compress to 1.496" (Valve open)	155 - 165	
CAMSHAFT		
Chain		
Type	Silent Chain	
Adjustment	None	
Length	.24"	
Number of links	.48	
Pitch	.500"	
Width	.750"	
Bearing Clearance		
Number	.5	
New limits	.001"-.0022"	
Worn limits, not over	.004"	
Out-of-round, not over	.002"	
Valve Timing (with ramp at .001" lift)		
Intake opens	21° B.T.D.C.	
Intake closes	111° A.B.D.C.	
Exhaust opens	73° B.B.D.C.	
Exhaust closes	55° A.T.D.C.	
Valve Lift		
Intake	.457"	
Exhaust	.473"	

Items	All Series Unless Otherwise Noted
Duration	
Intake	.312°
Exhaust	.308°
Valve Overlap	.76°
CONNECTING RODS	
Bearing Material	Aluminum
Clearance between bearing and shaft --	
New limits	.0005" - .0028"
Worn limits, not over	.0035"
Diameter lower end, without bearing	2.6243" - 2.6250"
Length, center to center	6.75"
End play of rods on crank pin	.011" - .021"
PISTON RINGS	
Clearance between rings and sides of groove in piston --	
Compression rings	.0017" - .0040"
Oil rings	NONE - Side Sealing
Gap between ends	
Compression rings	.013" - .025"
Oil rings	.015" - .055"
Number of compression rings	2
Number of oil rings	1
Width of compression ring groove	.0802" - .0810"
Width of oil ring groove	.188" - .189"
Diameter at bottom of groove	
Oil ring	3.880" - 3.874"
Compression rings	3.843" - 3.849"
PISTON PINS	
Clearance between pin and piston --	
New limits	.0002" - .0004"
Pin length	3.030"
Pin diameter	.9994" - .9999"
PISTONS AND CYLINDERS	
Cylinder bore out-of-round (new or reground limit)	
Not over	.0005"
Piston Taper, not over	.0005" - .002"
Piston Material	Aluminum Alloy
Piston skirt top clearance	.0006" - .0010"
Piston skirt bottom clearance	-.0014" - +.0005"

Cylinder and piston sizes (as indicated by letters stamped on the cylinder head gasket surface). The letters are in groups of two for adjacent cylinders (such as "H" and "B") midway between the two cylinders. The letters denote the cylinder piston sizes as shown on page 6-133).

SPECIFICATIONS (Cont'd.)

Items	All Series Unless Otherwise Noted	
Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.3000 - 4.3002	4.2992 - 4.2994
B	4.3002 - 4.3004	4.2994 - 4.2996
C	4.3004 - 4.3006	4.2996 - 4.2998
D	4.3006 - 4.3008	4.2998 - 4.3000
E	4.3008 - 4.3010	4.3000 - 4.3002
H	4.3010 - 4.3012	4.3002 - 4.3004
J	4.3012 - 4.3014	4.3004 - 4.3006
K	4.3014 - 4.3016	4.3006 - 4.3008
L	4.3016 - 4.3018	4.3008 - 4.3010
M	4.3018 - 4.3020	4.3010 - 4.3012
†AA	4.3100 - 4.3102	4.3092 - 4.3094
†BB	4.3102 - 4.3104	4.3094 - 4.3096
†CC	4.3104 - 4.3106	4.3096 - 4.3098
†DD	4.3106 - 4.3108	4.3098 - 4.3100
†EE	4.3108 - 4.3110	4.3100 - 4.3102
†HH	4.3110 - 4.3112	4.3102 - 4.3104
†JJ	4.3112 - 4.3114	4.3104 - 4.3106
†KK	4.3114 - 4.3116	4.3106 - 4.3108
†LL	4.3116 - 4.3118	4.3108 - 4.3110
†MM	4.3118 - 4.3120	4.3110 - 4.3112
OIL PUMP		
Oil pump type		Spur Gear
Backlash between drive gears		.008" - .012"
Clearance between pump body and gears --		
New limits		.003" - .005"
Worn limits, not over		.005"
No. of teeth on each gear		9

Items	All Series Unless Otherwise Noted
CRANKSHAFT AND MAIN BEARINGS	
Clearance, main bearings --	
New limits	.0003" - .0026"
Worn limits, not over	.0045"
Main bearing caps --	
Screw thread diameter	1/2"
Main bearing journal, diameter	3.250"
Main bearing journals, out-of-round not over	.00025"
Main bearing journal length	
No. 1 and No. 5	1.1925"
No. 2 and No. 4	1.0595"
No. 3	1.0670"
Main bearings material	M-400 Aluminum and M-100 Babbitt
Crankpin diameter	2.500"
Crankpin out-of-round not over	.00025"
End play in crankshaft --	
New limits	.002" - .012"
Worn limits	.015"
OIL PRESSURE REGULATOR	
Clearance between valve plunger and housing --	
New limits	.0020" - .0035"
Worn limits, not over	.005"
Normal pressure at 30 mph	
Minimum	35 psi
Idle (average)	10 psi
Spring	
Free length	2.57" - 2.69"
Lbs. required to compress to 1-7/16"	7-1/2 - 8-1/2
Valve opens at	35 - 40 psi

†Except Eldorado

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
280-M	Camshaft Sprocket to Camshaft Screws	5/16-18	18 ft. lbs.
260-M	Carburetor to Intake Manifold Screw (Front)	5/16-18	11 ft. lbs.
280-M	Carburetor to Intake Manifold Screw (Rear)	5/16-18	15 ft. lbs.
1038	Connecting Rod Nut	3/8-24	40 ft. lbs.
300-M	Cylinder Head to Cylinder Block Screw (All-Special) Oiled	1/2-13	115 ft. lbs.
Special	Cylinder Head Temperature Switch	3/8-24	6 ft. lbs.
286-M	Distributor Clamp Nut	5/16-24	15 ft. lbs.
286-M	Engine Front Support Mount to Cylinder Block Nut	3/8-24	21 ft. lbs.
286-M	Engine Front Support Mount Stud to Frame Nut	1/2-20	52 ft. lbs.
300-M	Engine Rear Support Mount to Rear Support Cross Member Bolt	3/8-16	45 ft. lbs.
280-M	Engine Rear Support Cross Member to Frame Bolt	5/16-18	20 ft. lbs.
280-M	Engine Rear Support Mount to Transmission Extension Housing Bolt	7/16-24	50 ft. lbs.
286-M	Eldorado Engine Front Mounting Support Bracket to Crankcase Nut	3/8-24	21 ft. lbs.
286-M	Eldorado Engine Front Support Cushion to Frame Nut	7/16-14	35 ft. lbs.
300-M	Eldorado Engine Front Support Cushion to Engine Mounting Bracket Nut	7/16-20	57 ft. lbs.
280-M	Eldorado Engine Rear Support Bracket to Transmission Bolt	7/16-14	50 ft. lbs.
280-M	Eldorado Engine Rear Support Assembly to Bracket	7/16-14	46 ft. lbs.
280-M	Eldorado Engine Rear Support Assembly to Frame (Bolt or Nut)	1/2-13	52 ft. lbs.
280-M	Exhaust Manifold to Cylinder Head Screw	3/8-16	35 ft. lbs.
260-M	Fan Blade Assembly Mounting Screw	15/16-24	18 ft. lbs.
280-M	Flywheel to Converter Housing Screw	3/8-16	30 ft. lbs.
280-M	Flywheel to Crankshaft Screw (All)	7/16-20	75 ft. lbs.
280-M	*Front Cover to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	*Front Cover to Cylinder Block Screw	3/8-16	22 ft. lbs.
280-M	Fuel Pump to Engine Screw	5/16-18	12 ft. lbs.
286-M	Fuel Pump to Engine Nut	5/16-14	12 ft. lbs.
280-M	Fuel Pump Eccentric	3/8-16	35 ft. lbs.
260-M	Generator Adjusting Link to Generator Screw	5/16-18	10 ft. lbs.
260-M	Generator Support Bracket Screw	3/8-16	17 ft. lbs.
1112	Generator Support Bracket Nut	3/8-24	17 ft. lbs.
1010	Heater Hose Clamps	10-24	14 ft. lbs.
260-M	Ignition Coil Mounting Screw	5/16-18	15 ft. lbs.
280-M	Intake Manifold to Cylinder Head Screw	3/8-16	30 ft. lbs.
300-M	Main Bearing Cap to Cylinder Block Screw	1/2-13	90 ft. lbs.
Special	Oil Pan Drain Plug	1/2-20	25 ft. lbs.
1010	Oil Pan to Cylinder Block Nut	5/16-24	10 ft. lbs.
1010	Oil Pan to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	Oil Pick-up and Strainer to Cylinder Block Screw	5/16-18	15 ft. lbs.
286-M	Oil Pick-up Tube and Strainer Assembly to Main Bearing Bolt	3/8-24	35 ft. lbs.
Special	Oil Pressure Switch	1/4" Pipe	20 ft. lbs.
280-M	Oil Pump Assembly to Engine Screw	5/16-18	15 ft. lbs.
280-M	Pulley to Harmonic Balancer Screw	5/16-18	17 ft. lbs.
1010-M	**Rocker Arm Cover to Cylinder Head Screw/Washer	1/4-20	30 in. lbs.
300-M	Rocker Arm Support Bolt	7/16-14	70 ft. lbs.
1018	Starter Motor Brace Mounting Screw	5/16-18	12 ft. lbs.
1018	Starter Motor Brace Mounting Nut	1/4-20	70 in. lbs.
280-M	Starter Motor Mounting Screws	3/8-16	45 ft. lbs.
Special	Spark Plug	14mm	25 ft. lbs.

TORQUE SPECIFICATIONS (Cont'd.)

Material No.	Application	Thread Size	Torque
Special	Temperature Indicator Switch	1/2" Pipe	40 ft. lbs.
260-M	Thermostat Housing to Engine Screw	5/16-18	10 ft. lbs.
280-M	Transmission Housing to Cylinder Block	3/8-16	35 ft. lbs.
260-M	*Water Pump to Front Cover Screw	1/4-20	70 in. lbs.
280-M	*Water Pump to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	*Water Pump to Cylinder Block Screw	3/8-16	22 ft. lbs.

*Refer to Fig. 6-147 for proper location.
**Retorque rocker arm covers after engine has been run.

(NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.)

SPECIAL TOOLS

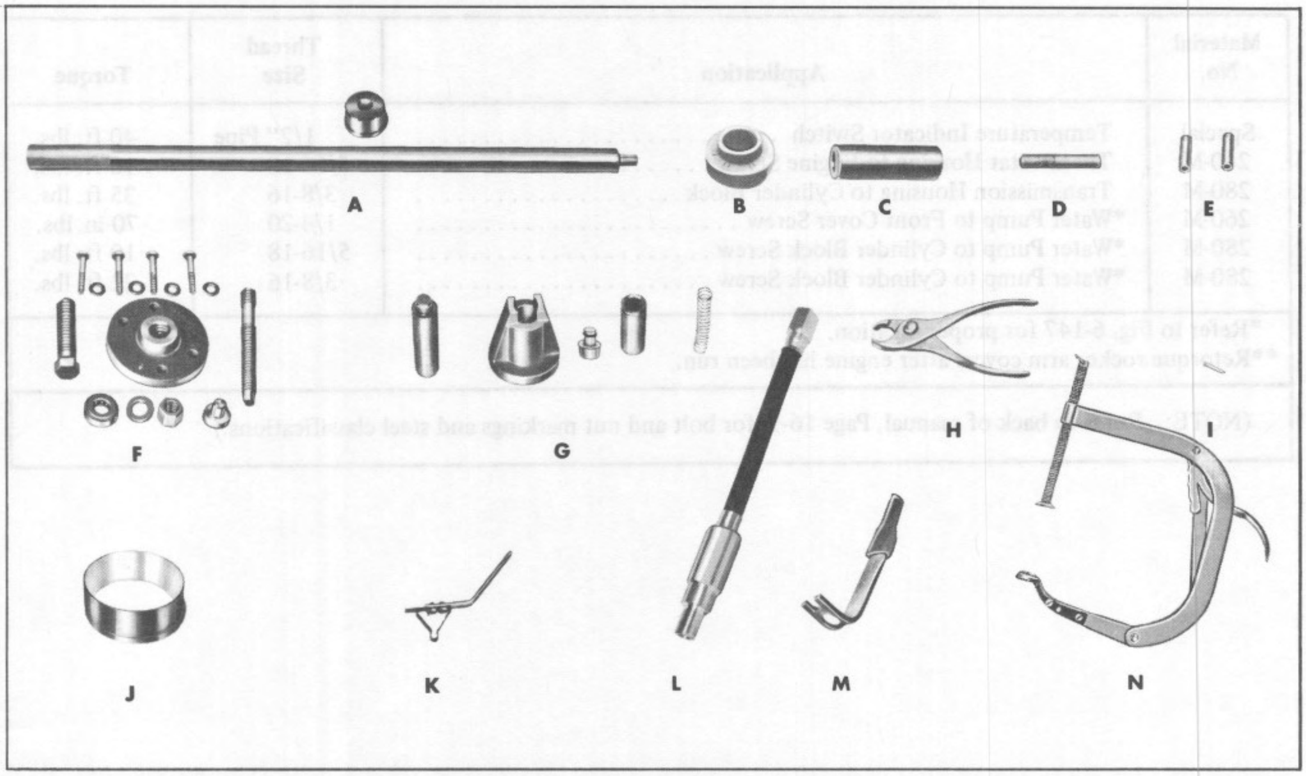


Fig. 6-166 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21054	Camshaft Bearing Remover and Installer Set	G	J-8390-04	Piston Pin Remover and Installer Set
B	J-22770	Front Cover Oil Seal Installer	H	J-3049	Valve Lifter Remover
C	J-4160	Hydraulic Valve Lifter Plunger Remover	I	J-8080	Main Bearing Upper Shell Remover
			J	J-22748	Piston Ring Compressor
D	J-2730	Valve Lifter Lock Ring Installer	K	J-3074	Valve Lifter Leak-Down Tester
E	J-3224	Connecting Rod Bolt Guide Set	L	J-22794	Adapter
F	J-21052	Harmonic Balancer Remover and Installer Set	M	J-22765	Valve Spring Compressor
			N	J-8062	Valve Spring Compressor

THEORY OF OPERATION

(NOTE: For service information pertaining to the Eldorado transmission refer to the latter portion of this section, Page 7-69.)

The same Turbo Hydra-matic automatic transmission, Fig. 7-1, is used on all Cadillac rear wheel drive cars and is identified by the letters AA that appear in the upper corners of the name plate, Fig. 0-2.

The 1974 transmission is similar to 1973. Refer to the 1973 Shop Manual for information pertaining to Theory of Operation, Hydraulic System Description, Valve and Hydraulic Control Functions and Oil Circuit Diagrams.

DIAGNOSIS

Turbo Hydra-Matic 400 Diagnosis Procedure

(NOTE: The following information, unless specifically noted elsewhere, is applicable to the Eldorado. See Page 7-69.)

CAUTION: In the event of a major transmission malfunction, replace filter assembly, flush oil cooler and lines before installing new fluid. This is particularly important in the case of a converter or pump malfunction.

This Diagnosis Guide should be used in the following sequence to positively locate the problem:

1. Perform the "Preliminary Checking Procedure" in Part a, recording the readings in the Oil Pressure Reading row. After taking the pressure readings, place Low, Normal or High in each box of the Oil Pressure Pattern row.
2. Road test the car as described in Part b, if problem is not known.
3. Refer to the "Transmission Malfunction Related to Oil Pressure" chart in Part b. First, determine if malfunction noted is in this chart. If so, compare Oil Pressure Pattern row in Part a with Part b. A dash on the "Transmission Malfunction Related to Oil Pressure" chart means that the oil pressure reading has no significance under the test condition.

If transmission malfunction is found in this chart, follow the directions indicated in the Malfunction column. The oil pressure pattern will indicate where the malfunction is.

The only time it is necessary to determine a pressure drop (the control valve assembly-governor line pressure check, part b) is when there is "No 1-2 Upshift and/or Delayed Upshift" and all oil pressure readings are normal.

It will not be necessary to repeat oil pressure readings taken during preliminary checks should this be called for during further tests.

4. If malfunction cannot be determined by the chart in Part b, or if upon completion of these tests, it is not found, see the "Transmission Troubleshooting Guide", starting with Part c to locate malfunction not related to oil pressure.

All malfunctions, both those related to oil pressure and those that are not, are listed in the "Transmission Troubleshooting Guide". Always perform the "Preliminary Checking Procedure" first as it provides a positive means to isolate the problem if the malfunction can be diagnosed by this procedure.

5. After correcting malfunction, road test car as described in Part b.

(NOTE: This information pertains to all Cadillac transmissions. For additional illustrations on the Eldorado transmission, see the later portion of this section.)

A. Preliminary Checking Procedure

Perform checking procedure shown on Part a.

B. Transmission Road Testing

1. Connect portable tachometer to engine. Engine rpm will identify shift points.
2. Place selector in "Drive Left" position and accelerate the vehicle from rest at a minimum throttle opening. The specifications for shift points are:

Upshift	Maximum
1-2	15 mph
2-3	30 mph

Accelerate the vehicle from rest at wide-open throttle. The specifications for shift points are:

Upshift	Maximum
1-2	44-48 mph
2-3	77-83 mph
Detent Downshifts	
3-2	68-73 mph
2-1	28-32 mph

Downshifts should occur (3-2 and 2-1) as the vehicle speed decreases to 0 mph. Stop car.

3. Place selector in "Drive Right" position and accelerate the vehicle from rest. A 1-2 shift should occur at all throttle openings. No 2-3 shift can be obtained in this range. Stop car.
4. Place selector in "Low". No upshift should occur in this range regardless of the throttle opening.
5. Position the selector in "Drive Left" and accelerate the vehicle to 35 mph and move the selector to "Drive Right". A 3-2 downshift should occur, increasing the engine rpm and an engine braking effect should be noticed on deceleration.
6. With the selector in "Drive Right" at approximately 25 mph, but not over 40 mph, at closed throttle, move the selector to "Low". A 2-1 downshift should occur, increasing the engine rpm and an engine braking effect should be noticed on deceleration. Stop car.
7. Place selector in "Reverse" and check for reverse operation.

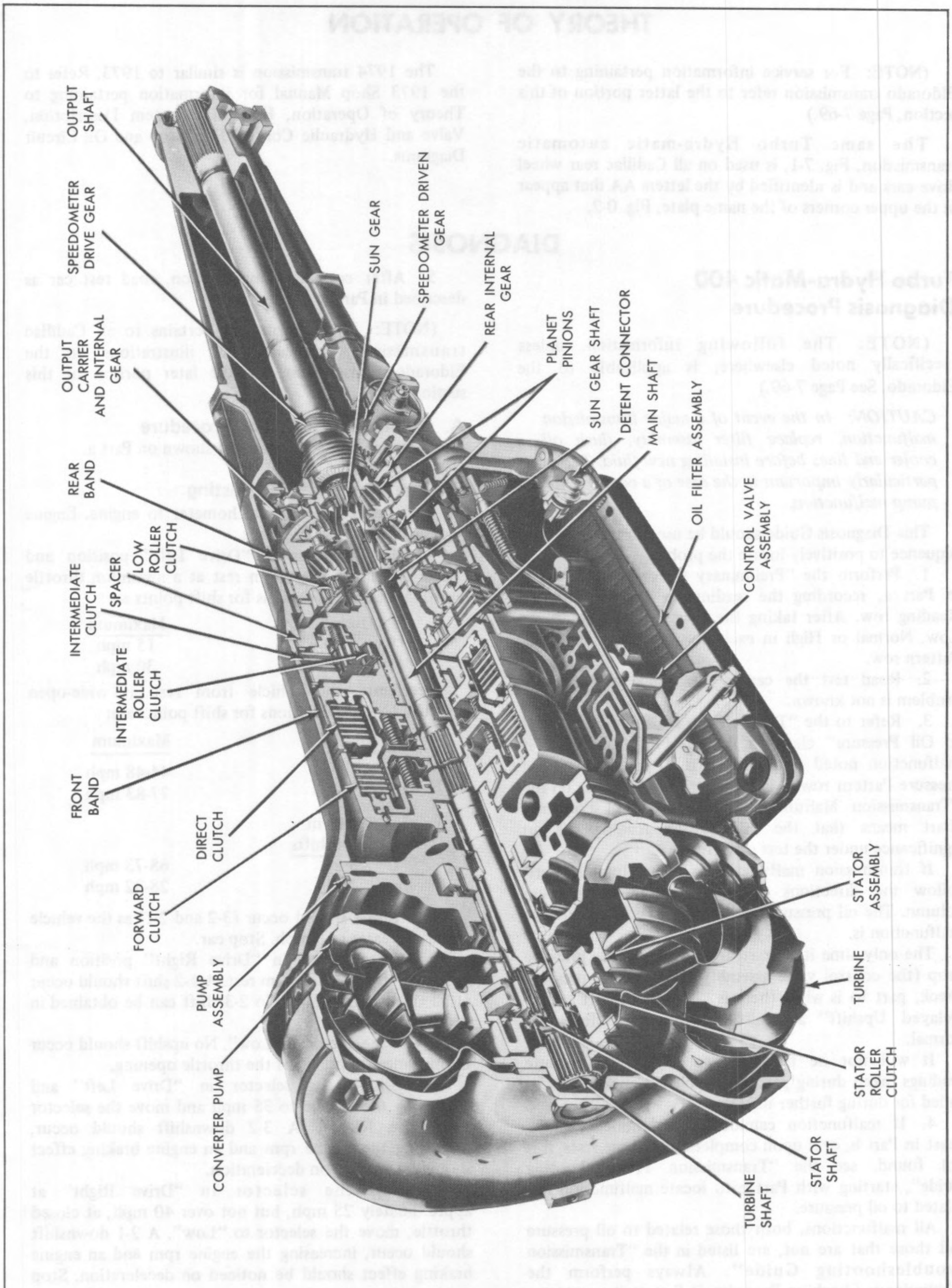
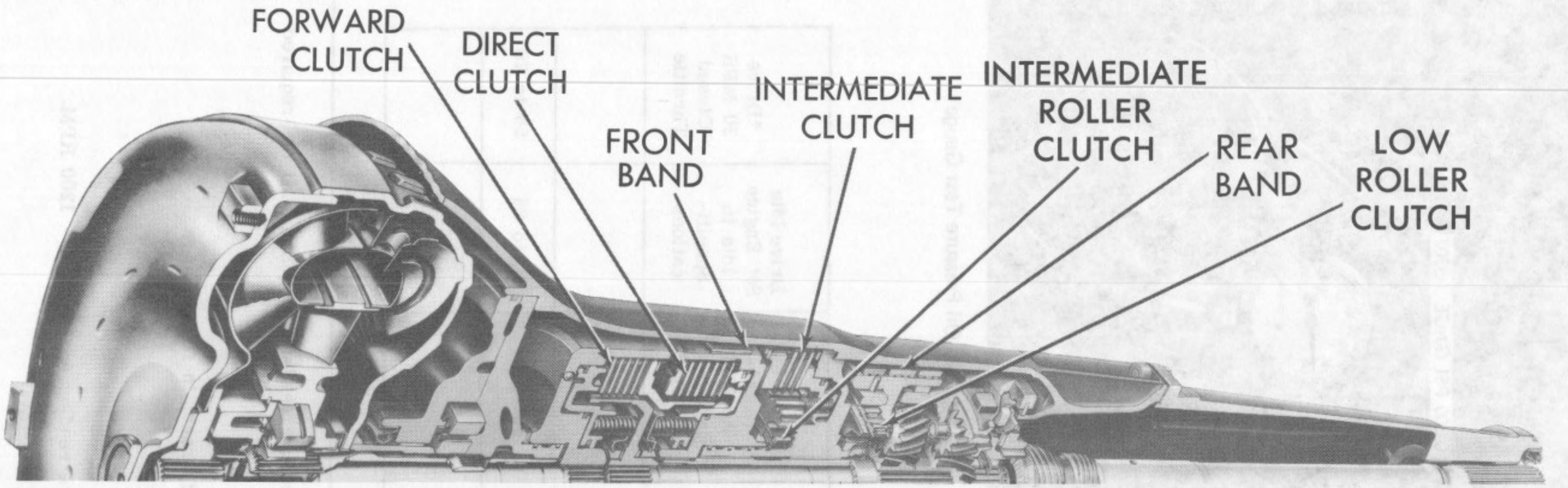


Fig. 7-1 Turbo Hydra-Matic Transmission—Cutaway View



SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	FRONT BAND	INT. CLUTCH	INT. ROLLER CLUTCH	LOW ROLLER CLUTCH	REAR BAND
PARK—NEUT.	60-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE LEFT 1	60-150	ON	OFF	OFF	OFF	OFF	ON	OFF
2	60-150	ON	OFF	OFF	ON	ON	OFF	OFF
3	60-150	ON	ON	OFF	ON	OFF	OFF	OFF
DRIVE RIGHT 1	150	ON	OFF	OFF	OFF	OFF	ON	OFF
2	150	ON	OFF	ON	ON	ON	OFF	OFF
LO 1	150	ON	OFF	OFF	OFF	OFF	ON	ON
2	150	ON	OFF	ON	ON	ON	OFF	OFF
REV.	95-240	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-2 Band, Roller Clutch and Clutch Application Chart

a. Preliminary Checking Procedure

CHECK TRANSMISSION OIL LEVEL
SEE NOTE 5 or 62

CHECK MANUAL LINKAGE AND CORRECT
SEE NOTE 3 or 60

INSTALL OIL PRESSURE GAGE

CHECK OIL PRESSURE IN FOLLOWING MANNER

CAUTION: Total Running Time for This Combination Not to Exceed 2 Minutes.

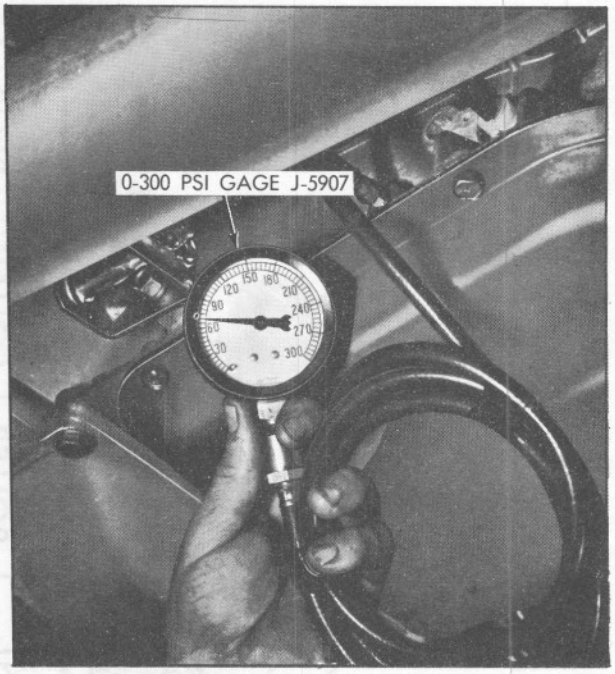


Fig. 7-3 Oil Pressure Test Gauge

Range	Drive (Left) -Brakes Applied Engine at 1000 RPM	Drive-R Brakes Applied Engine at 1000 RPM	Reverse Brakes Applied Engine at 1000 RPM	Neutral Brakes Applied Engine at 1000 RPM	Drive Idle Set Engine Idle to Specifi-cations	*Drive 30 MPH Closed Throttle
Oil Pressure Reading						
Normal P.S.I.	60 to 90	135 to 160	95 to 150	55 to 70	60 to 85	55 to 70
Oil Pressure Pattern - Low, Normal or High						

*The following alternate check may be used to obtain this pressure reading and permit all the required pressure checks to be made without the necessity of a road test.

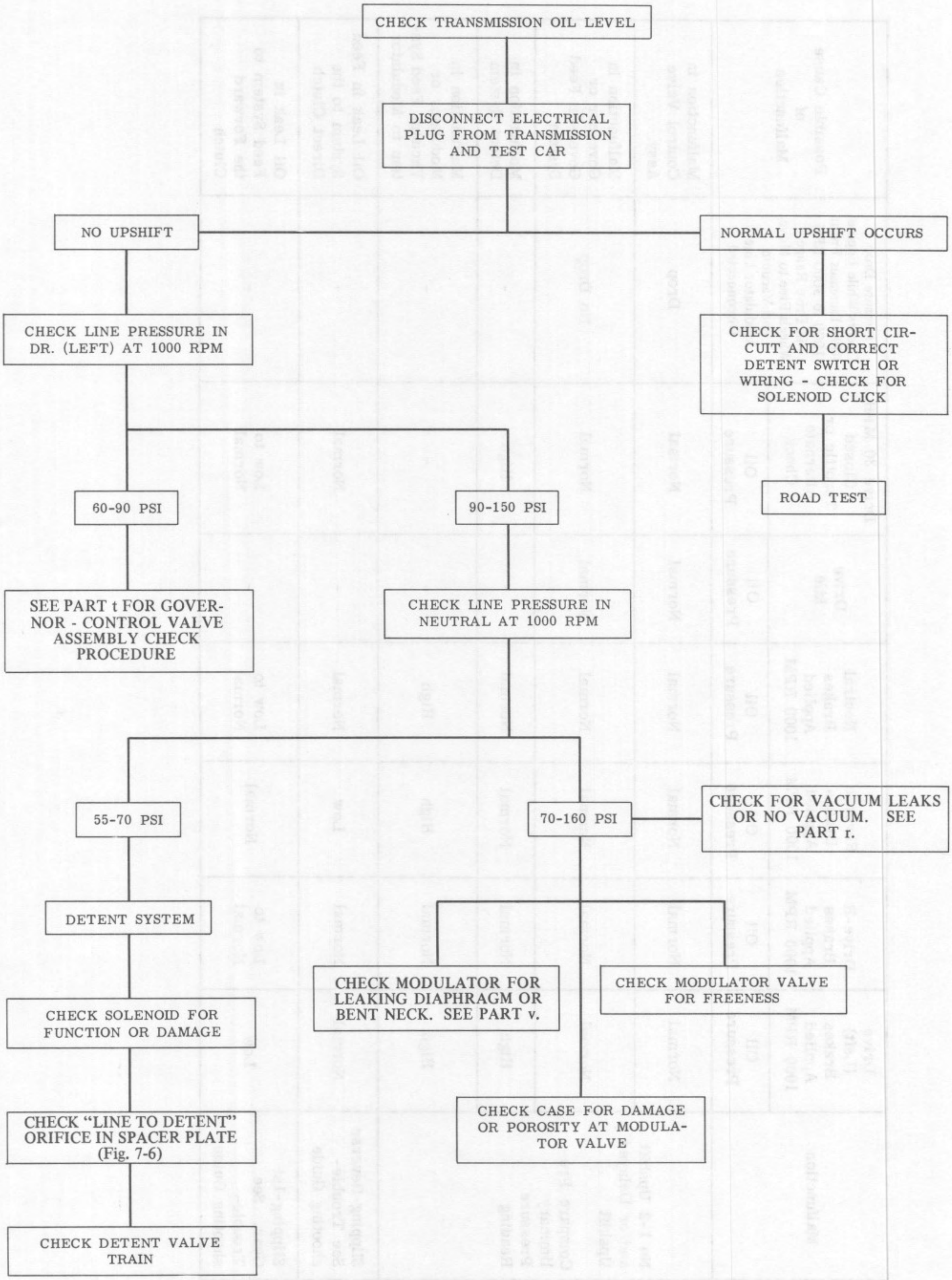
1. Vehicle on hoist - driving wheels off ground, foot off brake, in Drive Range.
2. Engine 2000 RPM.
3. Close throttle (foot off accelerator) and take pressure reading engine 2000 - 1200 RPM.

NOTE: With closed throttle and driving wheels off the ground, engine RPM will drop rapidly. Pressure reading must be taken within RPM's indicated and with closed throttle.

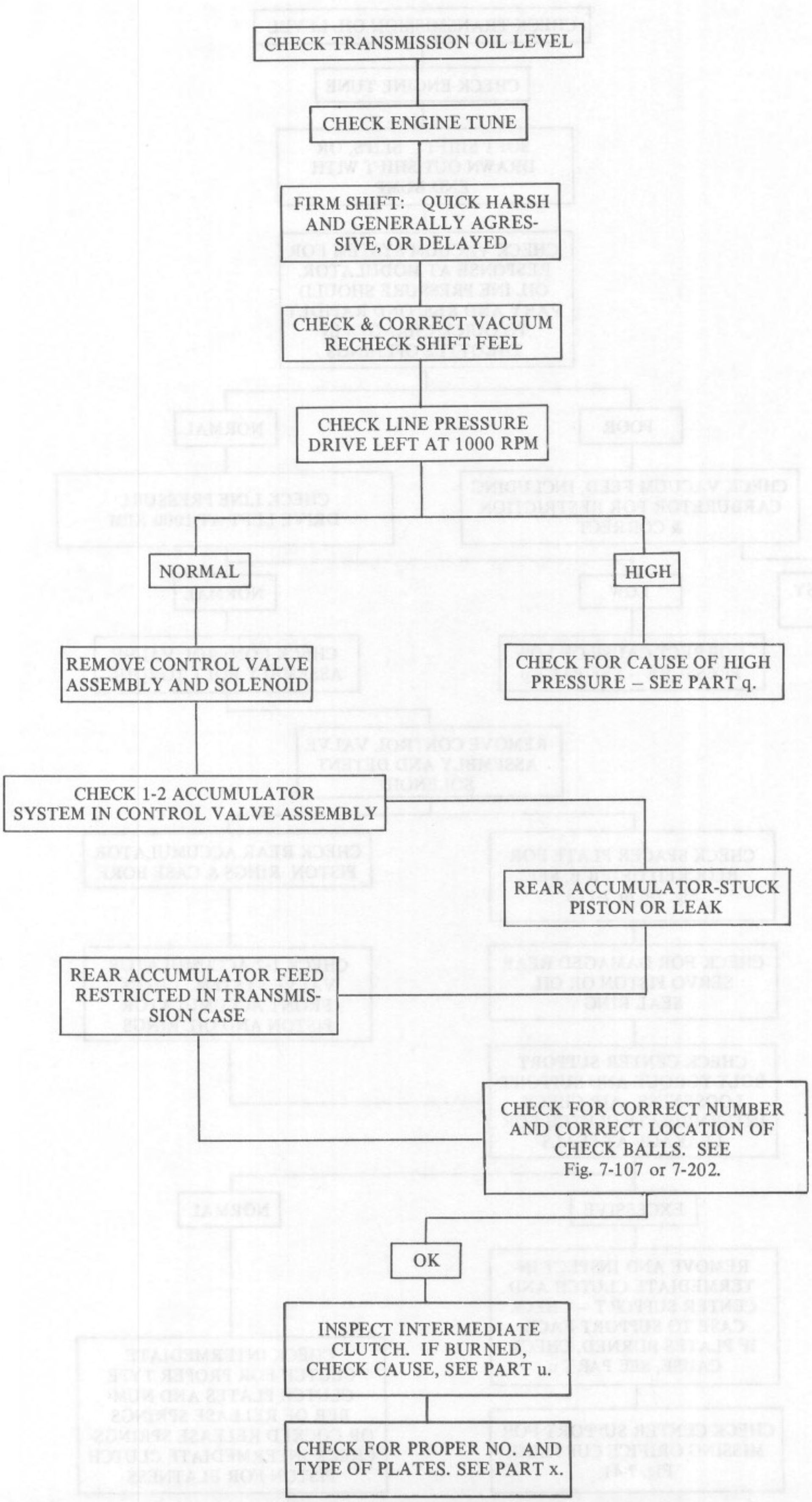
b. Transmission Malfunction Related to Oil Pressure

Malfunction	Drive (Left) Brakes Applied 1000 RPM	Drive-R Brakes Applied 1000 RPM	Reverse Brakes Applied 1000 RPM	Neutral Brakes Applied 1000 RPM	Drive Idle	Drive 30 MPH Closed Throttle or Alternate Check	Pressure Drop Occurs While Engine RPM Increases From 1000 to 3000 RPM in Drive Range Wheels Free to Move and Vacuum Modulator Line Disconnected	Possible Cause of Malfunction
	Oil Pressure	Oil Pressure	Oil Pressure	Oil Pressure	Oil Pressure	Oil Pressure		
No 1-2 Upshift and/or Delayed Upshift Compare Preliminary Pressure Reading	Normal	Normal	Normal	Normal	Normal	Normal	Drop	Malfunction in Control Valve Assy.
	Normal	Normal	Normal	Normal	Normal	Normal	No Drop	Malfunction in Governor or Governor Feed System
	High	Normal	Normal	Normal	-	High	-	Malfunction in Detent System
	High	Normal	High	High	-	-	-	Malfunction in Modulator or Vacuum Feed System to Modulator
Slipping-Reverse See Trouble-shooting Guide	Normal	Normal	Low	Normal	-	Normal	-	Oil Leak in Feed System to the Direct Clutch
Slipping-1st Gear. See Trouble-shooting Guide	Low	Low to Normal	Normal	Low to Normal	-	Low to Normal	-	Oil Leak in Feed System to the Forward Clutch

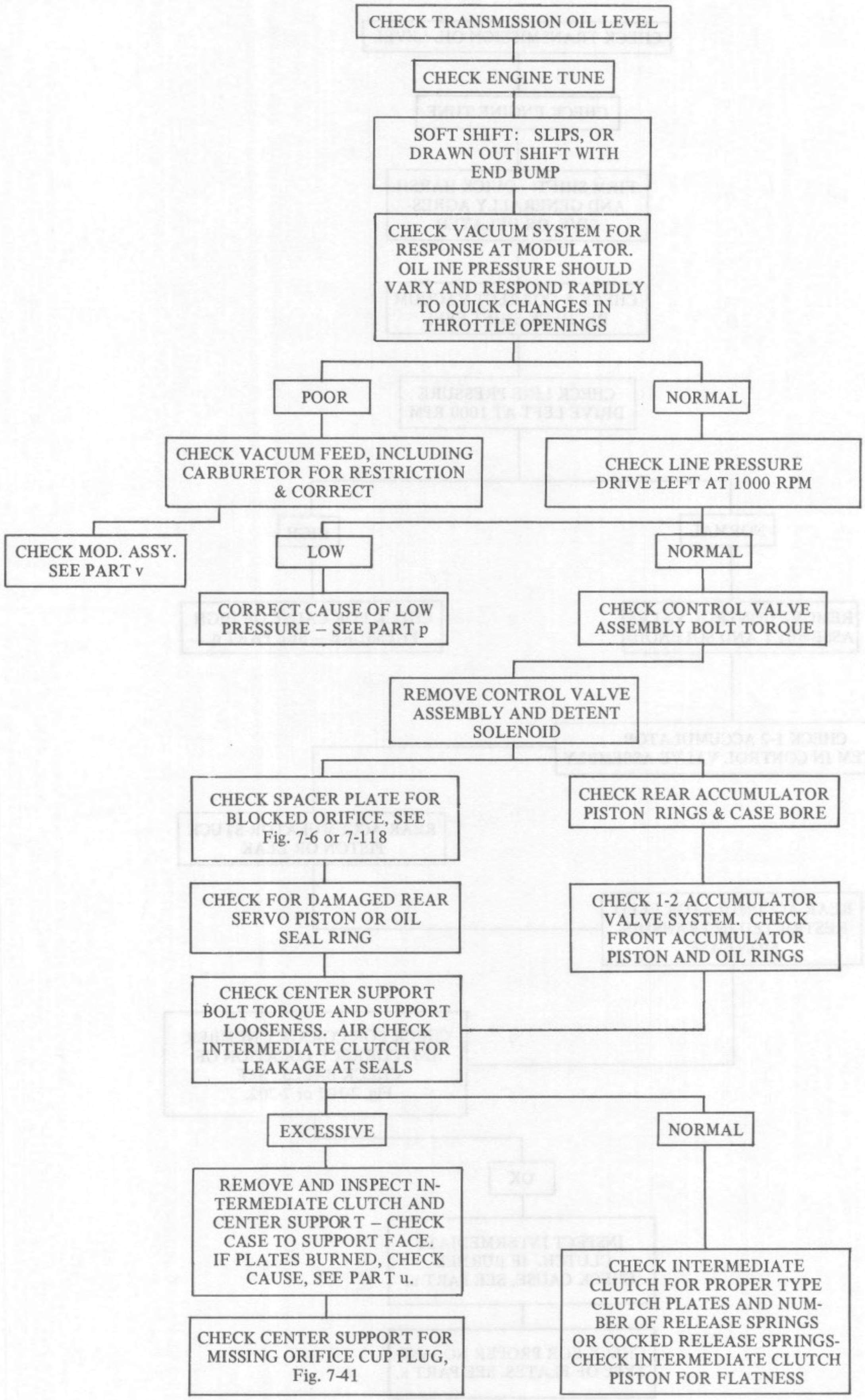
c. No. 1-2 Upshift and/or Delayed Upshift



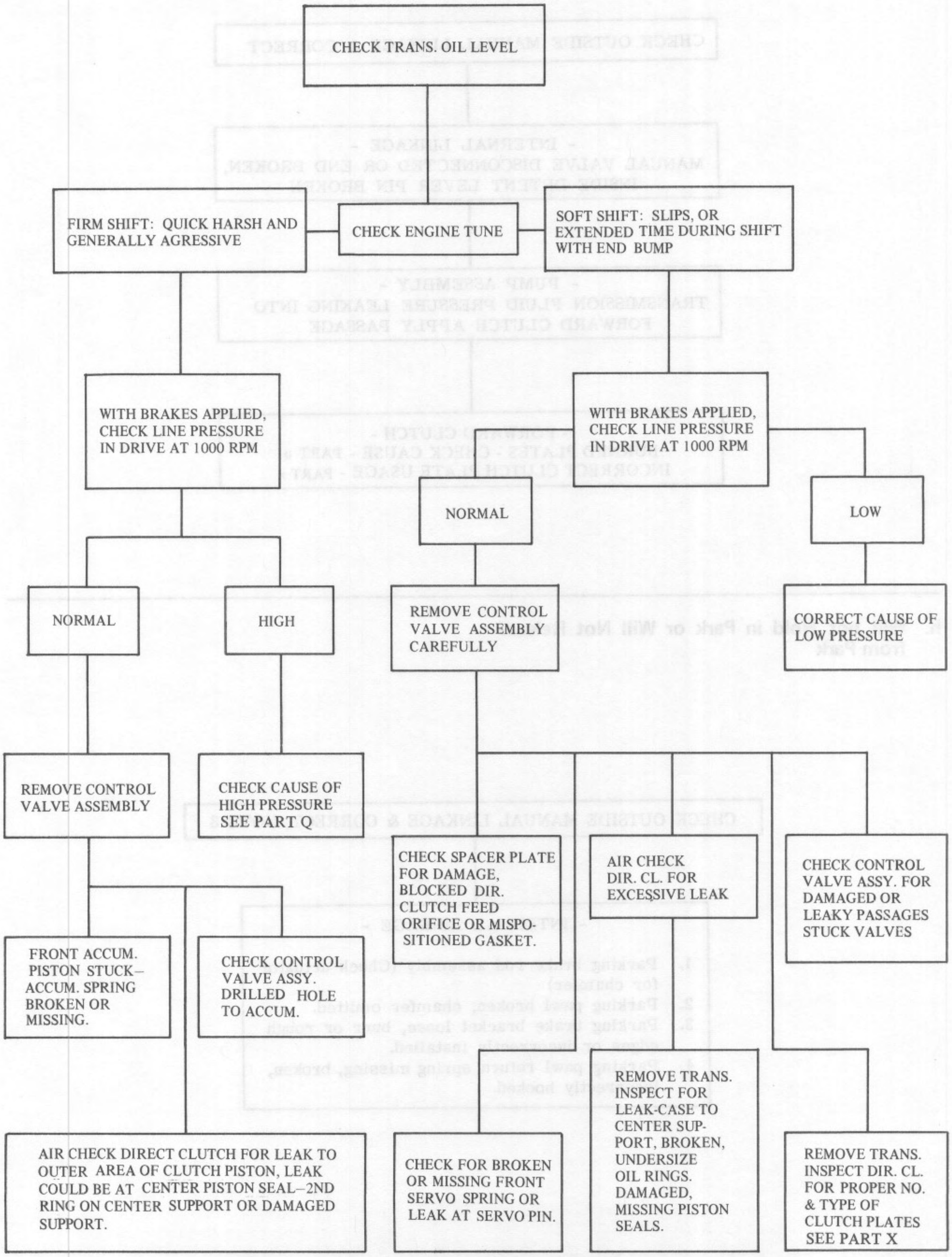
d. 1-2 Shift Feel Complaint–Firm Shift



e. 1-2 Shift Feel Complaint–Soft Shift



f. 2-3 Shift Complaint



g. Drive in Neutral

CHECK OUTSIDE MANUAL LINKAGE & CORRECT

- INTERNAL LINKAGE -
MANUAL VALVE DISCONNECTED OR END BROKEN,
INSIDE DETENT LEVER PIN BROKEN

- PUMP ASSEMBLY -
TRANSMISSION FLUID PRESSURE LEAKING INTO
FORWARD CLUTCH APPLY PASSAGE

- FORWARD CLUTCH -
BURNED PLATES - CHECK CAUSE - PART u
INCORRECT CLUTCH PLATE USAGE - PART x

h. Will not Hold in Park or Will Not Release from Park

CHECK OUTSIDE MANUAL LINKAGE & CORRECT, NOTE 3

- INTERNAL LINKAGE -

1. Parking brake rod assembly (Check actuator for chamfer)
2. Parking pawl broken, chamfer omitted.
3. Parking brake bracket loose, burr or rough edges or incorrectly installed.
4. Parking pawl return spring missing, broken, incorrectly hooked.

i. No Engine Braking—Lo Range—1st Gear

- CASE ASSEMBLY -
LO-REVERSE CHECK BALL MISPOSITIONED OR MISSING.
CASE DAMAGED AT LO-REVERSE CHECK BALL AREA

- REAR SERVO -
OIL SEAL RING, BORE OR PISTON DAMAGED
REAR BAND APPLY PIN SHORT, IMPROPERLY ASSEMBLED

- REAR BAND -
BROKEN, BURNED (CHECK FOR CAUSE), NOT ENGAGED
ON ANCHOR PINS AND/OR SERVO PIN.

---

j. No Engine Braking—Intermediate Range—2nd Gear

-FRONT SERVO & ACCUMULATOR-
OIL RINGS AND/OR BORES LEAKING OR FRONT
SERVO PISTON COCKED OR STUCK

-FRONT BAND-
BROKEN, BURNED (CHECK FOR CAUSE) NOT
ENGAGED ON ANCHOR PIN AND/OR SERVO PIN

k. No Reverse or Slips in Reverse

CHECK TRANSMISSION OIL LEVEL – NOTE 5

CHECK OUTSIDE MANUAL LINKAGE & CORRECT – NOTE 3

WITH BRAKES APPLIED, CHECK LINE PRESSURE IN REVERSE @ 1000 RPM

NORMAL

LOW

CORRECT CAUSE - PART p

- CONTROL VALVE ASSEMBLY -

1. 2-3 Valve train stuck open (This will also cause a 1-3 upshift in drive range)
2. Reverse feed passage - Cross channel leak, porosity in case or valve body passage, gaskets leaking.

- REAR SERVO & ACCUMULATOR -

1. Servo piston seal ring damaged or missing
2. Short band apply pin (This may also cause no overrun braking or slips in overrun braking-lo range)
   Refer to Shop Manual for pin selection
3. Rear servo piston or bore.

- FORWARD CLUTCH -
Clutch does not release (will also cause Drive in Neutral)

- DIRECT CLUTCH BURNED -
Check cause - PART u

- REAR BAND -
Broken, burned, loose lining, apply pin or anchor pins not engaged.

CENTER SUPPORT
Oil seal rings or grooves damaged or worn.

l. 1st and 2nd Speeds Only, No 2-3 Upshift

- CONTROL VALVE ASSEMBLY -
STUCK 2-3 VALVE, GASKET MISPOSITIONED OR LEAKING

- DIRECT CLUTCH -
BURNED, CHECK CAUSE - Part u

-IMPROPER VACUUM -
CHECK CAUSE, PART r

m. No Drive in Drive Range

CHECK TRANSMISSION OIL LEVEL
SEE NOTE 5

CHECK OUTSIDE MANUAL LINKAGE & CORRECT - SEE NOTE 3

WITH BRAKES APPLIED, CHECK
LINE PRESSURE IN DRIVE @ 1000 RPM

NORMAL

- PUMP ASSEMBLY -
FORWARD CLUTCH FEED
PASSAGE NOT DRILLED
OR RESTRICTED

- FORWARD CLUTCH BURNED -
CHECK CAUSE - SEE PART u

CHECK LO ROLLER CLUTCH
FOR DAMAGE
BACKWARDS INSTALLATION

LOW

CORRECT CAUSE OF LOW
PRESSURE - SEE PART p

n. No Detent Downshifts

VEHICLE ON LIFT, IGNITION ON (ENGINE NOT OPERATING)

DISCONNECT ELECTRICAL PLUG FROM TRANSMISSION-CONNECT TEST
LIGHT TO "DETENT" TERMINAL OF DISCONNECTED WIRE HARNESS

DEPRESS ACCELERATOR FULLY

LIGHT ON

– DETENT SOLENOID –
POOR CONNECTIONS, INOPERATIVE, SHORTED WIRE,
OPEN WIRE, VALVE STUCK, ORIFICE PLUGGED

– CONTROL VALVE ASSEMBLY –
CHECK DETENT VALVE TRAIN–SEE NOTE 36

LIGHT OFF

1. MALADJUSTED–REFER TO NOTE 4c FOR ADJUSTMENT PROCEDURES
2. MALFUNCTIONING SWITCH, CONNECTIONS, FUSE, SHORTED WIRE

o. Transmission Noisy

(NOTE: Before checking transmission for what is believed to be "Transmission Noise," make certain the noise is not from the water pump, generator, air conditioner, power steering. etc. These components can be isolated by removing the proper belt and running the engine no more than two minutes at one time.)

PARK, NEUTRAL & ALL DRIVING RANGES

– PUMP CAVITATION –

Oil level low - see NOTE 6 Plugged or restricted filter.* Wrong filter. Intake pipe "O" ring damaged. Intake pipe split, porosity in case intake pipe bore. Water in oil. Porosity or voids at transmission case (pump face) intake port. Pump to case gasket off location.

– PUMP ASSEMBLY –

Gears damaged, or malfunctioning, driving gear assembled backwards. Cresent interference. Buzzing noise-orifice cup plug in pressure regulator damaged or missing. Seal rings damaged or worn.

- CONVERTER –

Loose bolts (coverter to flywheel) converter damage.

FIRST, SECOND AND REVERSE

– PLANETARY GEAR SET –

Gears or thrust bearings damaged. Thoroughly clean thrust bearings & thrust races & closely inspect needles & surfaces for pitting and roughness. Front internal gear ring damaged.

DURING ACCELERA-TION – ANY GEAR

Transmission to cooler lines grounded to underbody. Motor mounts loose or broken.

425 Model Only - Drive Link Assembly, worn or damaged, may sound like popcorn popping.

SQUEAK AT LOW VEHICLE SPEEDS

SPEEDOMETER DRIVEN GEAR SHAFT SEAL – Seal requires lubrication or replacement.

EXTENSION HOUSING OIL SEAL – Seal requires lubrication or replacement.

*There is no approved service procedure for checking or cleaning the filter. If the filter is suspected of being plugged or restricted, it must be replaced.

p. Cause of Low Line Pressure

1. Low Transmission Oil Level.
2. Modulator Assembly see Part V.
3. Filter.
   A. Blocked or restricted.*
   B. "O" Ring on intake pipe and/or grommet omitted or damaged.
   C. Split or leaking intake pipe.
   D. Wrong filter assembly.
4. Pump.
   A. Pressure regulator or boost valve stuck.
   B. Gear clearance, damaged worn. (Pump will become damaged if drive gear is installed backwards, or if converter pilot does not enter crankshaft freely).
   C. Pressure regulator spring, too weak.
   D. Not enough spacers in pressure regulator.
   E. Pump to case gasket mispositioned.
   F. Malfunctioning pump body and/or cover.
   G. Mismatch pump cover/pump body.
5. Internal Circuit Leaks.

A. Forward clutch leak (pressure normal in neutral and reverse-pressure low in drive).

1. Check pump rings.
2. Check forward clutch seals.

B. Direct clutch leak (pressure normal in neutral, low, intermediate, and drive–pressure low in reverse).

1. Check center support oil seal rings.
2. Check direct clutch outer seal for damage.
3. Check rear servo and front accumulator pistons and rings for damage or missing.

6. Case Assembly.
   A. Porosity in intake bore area.
   B. Check case for intermediate clutch plug leak or missing plug.
   C. Lo-reverse check ball mispositioned or missing (this will cause no reverse and no overrun braking in Lo range).

*There is no approved service procedure for checking or cleaning the filter, if the filter is suspected of being plugged or restricted. It must be replaced.

q. Causes of High Line Pressure

1. Vacuum Leak.
A. Full leak (vacuum line disconnected.)
B. Partial leak in line from engine modulator.
C. Improper engine vacuum.
D. Vacuum operated accessory leak. (Hoses, vacuum advance, etc.).
2. Damaged Modulator.
A. Stuck valve.
B. Water in modulator.
C. Not operating properly - Part v.
3. Detent System.
A. Detent switch actuated (plunger stuck) or shorted.
B. Detent wiring shorted.
C. Detent solenoid stuck open.
D. Detent feed orifice in spacer plate blocked.
E. Detent solenoid loose.
F. Detent valve bore plug damaged.
G. Detent regulator valve pin short.
4. Pump.
A. Pressure regulator and/or boost valve stuck.
B. Incorrect pressure regulator spring.
C. Too many pressure regulator valve spacers.
D. Pump casting bad.
E. Pressure boost valve installed backwards or malfunctioning.
F. Aluminum bore plug has hole or otherwise malfunctioning.
G. Pressure boost bushing broken or otherwise malfunctioning.
5. Control Valve Assembly.
A. Spacer plate-to-case gasket off location.
B. Wrong spacer plate-to-case gasket.

r. Causes of Improper Vacuum at Modulator

1. Engine.
A. Requires tune up.
B. Loose vacuum fittings.
C. Vacuum operated accessory leak (hoses, vacuum advance, etc.)
2. Vacuum Line to Modulator.
A. Leak
B. Loose fitting.
C. Restricted orifice, or incorrect orifice size.
D. Carbon build up at modulator vacuum fitting.
E. Pinched line.
F. Grease or varnish material in pipe (no or delayed upshift-cold).

s. Causes of Oil Leaks

1. Transmission Oil Pan Leaks.
A. Attaching bolts not correctly torqued.
B. Improperly installed or damaged pan gasket.
C. Oil pan gasket mounting face not flat.
2. Case Extension Leak.
A. Attaching bolts not correctly torqued.
B. Rear seal assembly–damaged or improperly installed. (Propeller shaft yoke damaged)
C. Gasket–(Extension to case) damaged or improperly installed.
D. Porous casting.
E. Output shaft "O" ring damaged.
3. Case Leak.
A. Filler pipe "O" ring seal damaged or missing; misposition of filler pipe bracket to engine–"Loading" one side of the "O" ring.
B. Modulator assembly "O" ring seal–damaged or improperly installed.
C. Connector "O" ring seal–damaged or improperly installed.
D. Governor cover, gasket and bolts–damaged, loose; case face leak.
E. Damaged or porosity. Leak at speedometer driven gear housing or seal. Leak at speedometer hole plug.
F. Manual shaft seal–damaged, improperly installed.
G. Line pressure tap plug–stripped, shy sealer compound.
H. Vent pipe (refer to Item 5 below).
I. Porous case, or cracked at pressure plug boss.
4. Front End Leak.
A. Front seal–damaged (check converter neck for nicks, etc., also for pump bushing moved forward) garter spring missing.
B. Pump attaching bolts, and seals–damaged, missing, bolts loose.
C. Converter–leak in weld.
D. Pump "O" ring seal–damaged. (Also check pump oil ring groove and case bore).
E. Porous casting (pump or case).
F. Pump–drain back hole not open.
5. Oil Comes Out Vent Pipe.
A. Transmission over-filled.
B. Water in oil.
C. Filter "O" ring damaged or improperly assembled causing oil to foam.
D. Foreign material between pump and case or between pump cover and body.
E. Case–porous, pump face improperly machined.
F. Pump–shy of stock, porous.
G. Pump to case gasket mispositioned.
H. Pump breather hole blocked or missing.
I. Hole in intake pipe.
6. Oil Cooler Lines.
A. Connections at radiator loose or stripped.
B. Connections at case loose or stripped.
7. Modulator Assembly.
Diaphragm leaking - Part v.

t. Control Valve Assembly–Governor Line Pressure Check

1. Install line pressure gage.
2. Disconnect vacuum line to modulator.
3. With car on hoist (drive wheels off ground), foot off brake, in drive, check line pressure at 1000 RPM.
4. Slowly increase engine RPM to 3000 RPM and determine if a line drop occurs (10 psi or more).
5. If pressure drop occurs, disassemble, clean and inspect control valve assembly.
6. If no pressure drop occurs:
A. Inspect governor.
1. Stuck valve.
2. Weight freeness.

3. Restricted orifice in governor valve.

B. Governor feed system.

1. Check screen in governor feed pipe hole in case assembly.

2. Check for restrictions in governor pipe.

u. Causes of Burned Clutch Plates

(NOTE: Burned clutch plates can be caused by incorrect usage of clutch plates. Also, anti-freeze in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.)

1. Forward Clutch.

A. Check ball in clutch housing damaged, stuck or missing.

B. Clutch piston cracked, seals damaged or missing.

C. Low line pressure.

D. Manual valve mispositioned.

E. Restricted oil feed to forward clutch (Examples: Clutch housing to inner and outer areas not drilled, restricted or porosity in pump).

F. Pump cover oil seal rings missing, broken or undersize; ring groove oversize.

G. Case valve body face not flat or porosity between channels.

H. Manual valve bent and center land not ground properly.

2. Intermediate Clutch.

A. Rear accumulator piston oil ring, damaged or missing.

B. 1-2 accumulator valve stuck in control valve assembly.

C. Intermediate clutch piston seals damaged or missing.

D. Center support bolt loose.

E. Low line pressure (See Part p).

F. Intermediate clutch plug in case missing.

G. Case valve body face not flat or porosity between channels.

H. Manual valve bent and center land not ground properly.

3. Direct Clutch.

A. Restricted orifice in vacum line to modulator (poor vacuum response.)

B. Check ball in direct clutch piston damaged, stuck or missing.

C. Leaking Modulator bellows - Part v.

D. Center support bolt loose. (Bolt may be tight in support but not holding support tight to case).

E. Center support oil rings or grooves damaged or missing.

F. Clutch piston seals damaged or missing.

G. Front and rear servo pistons and seals damaged.

H. Manual valve bent and center land not cleaned up.

I. Case valve body face not flat or porosity between channels.

J. Intermediate roller clutch installed backwards.

K. 3-2 valve, 3-2 spring or 3-2 spacer pin installed in wrong location in 3-2 valve bore.

(NOTE: If direct clutch plates and front band are burned, check manual linkage. See Note 3.)

v. Vacuum Modulator Assembly

The following procedure is recommended for checking Turbo Hydra-matic modulator assemblies in the field before replacement is accomplished.

1. Vacuum Diaphragm Leak Check. Insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

CAUTION: Gasoline or water vapor may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric Leak Check. Using Hand Vacuum Pump, J-23738, apply 20" HG to diaphragm. Modulator should hold vacuum for 10 seconds. If vacuum drops, replace modulator.

3. Bellows Comparison Check. Make a comparison gage, as shown in Fig. 7-5, and compare the load of a known good Hydra-matic modulator with the assembly in question. Modulator Tension Tester J-24466 may also be used for this purpose.

a. Install the modulator that is known to be acceptable on either end of the gage.

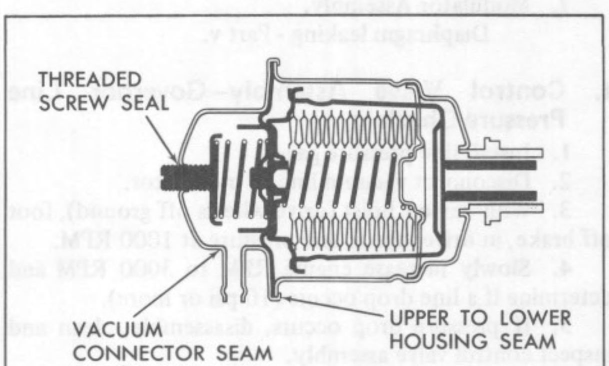


Fig. 7-4 Vacuum Modulator Cutaway View

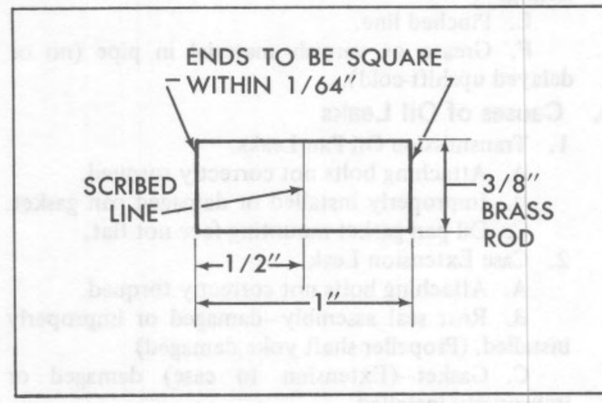


Fig. 7-5 Vacuum Modulator Test Gage

b. Install the modulator in question on the opposite end of the gage.

c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the gage. The gap between the opposite modulator sleeve end and the gage line should then be 1/16" or less. If the distance is greater than this amount, the modulator in question should be replaced.

4. Sleeve Alignment Check. Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the can. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

Once the modulator assembly passes all of the above tests, it is an acceptable part and should be re-used.

w. Downshift Solenoid Circuit Check

(NOTE: Before checking the downshift solenoid circuitry, make certain that the transmission downshift switch is properly adjusted as described in Note 4.)

1. With transmission shift lever in Park, turn ignition switch to "ON" position, but do not start car. Leave ignition switch "ON" throughout checking procedure.

2. Working under hood, slowly advance throttle linkage to wide open position. One click should be heard from transmission.

3. Allow throttle to return to closed position. One click should be heard from transmission.

4. If system performed as described above, downshift circuit is operating properly. If system does not perform as described above, proceed to step 5.

5. Use test light to check orange wire at connector on side of transmission case. Test light should light with throttle wide open and go out when throttle is released.

a. If system operates as described above, but did not perform properly during steps 1-3, replace solenoid after first checking to see that internal wiring is operational. Solenoid installation described in note 52 must be followed.

b. If light fails to light with throttle in wide open position, the circuit is open, proceed to step 6.

c. If light lights with throttle closed, the circuit is shorted. Proceed to step 9.

6. Remove air cleaner. Remove orange wire connector at transmission downshift switch. Use test light to check from the bare terminal at switch with throttle wide open.

a. If test light lights, replace orange wire. Recheck system.

b. If test light fails to light, proceed to step 7.

7. Check black striped orange feed wire at transmission downshift switch with test light.

a. If test light lights, replace transmission downshift switch. Recheck system.

b. If test light fails to light, proceed to step 8.

8. Check 10 amp (gages and transmission control fuse) in fuse panel.

a. If necessary to replace fuse, recheck system.

b. If fuse is all right, it will be necessary to locate the open in the wiring. Test the circuit continuity from the black-striped orange wire at the downshift switch to the battery.

9. Remove air cleaner. Remove orange wire connector at transmission downshift switch. Use test light to check from the bare terminal at switch with throttle closed.

a. If test light fails to light, orange wire is shorted. Correct shorting condition.

b. If test light lights, proceed to step 10.

10. With throttle in closed position, check black striped orange feed wire at transmission downshift switch.

a. If test light fails to light, replace transmission downshift switch. Recheck system.

b. If test light lights, it will be necessary to locate the short in the wiring. Test the circuit from the black striped orange wire at the downshift switch to the battery.

x. Type AA Clutch Parts

Clutch	No. of Flat Steel Clutch Plates	No. of Waved Steel Clutch Plates
Forward Clutch	*4	1
Direct Clutch	*5	1
Intermediate Clutch	2	1

*Steel Plate Thickness - .0915"

Clutch	No. of Clutch Composition Plates	No. of Piston Release Springs
Forward Clutch	5	16
Direct Clutch	6	14
Intermediate Clutch	3	3

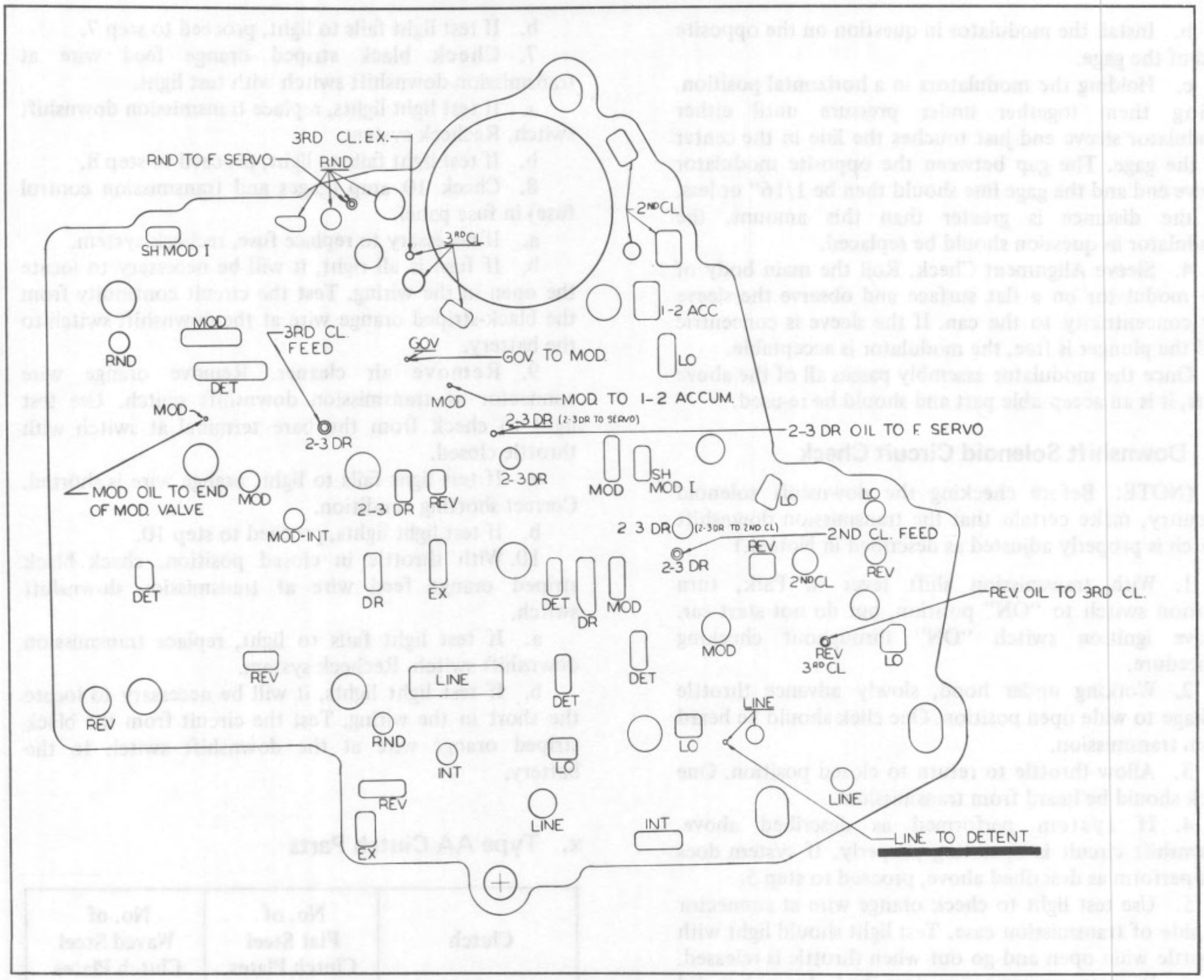


Fig. 7-6 Spacer For Control Valve Assembly

SERVICE INFORMATION

1. Transmission Case Repairs

a. Repairing Tapped Holes

Thread repair inserts are available from various sources and are recommended for restoring damaged threads. The instructions provided with your specific tool should be followed.

b. Repairing Case Porosity

Leaks caused by case porosity can be successfully repaired with the transmission in the car, using the following procedure:

1. Road test and bring transmission to operating temperature approximately 170 degrees.

2. Raise car on a hoist with engine running and locate source of oil leak.

(NOTE: Use of a mirror is helpful in finding leaks.)

3. Shut engine off and thoroughly clean area to be repaired with a cleaning solvent and a brush. Air dry.

(NOTE: A clean, dry soldering acid brush can be used to clean the area and also to apply the epoxy cement.)

4. Using instructions provided, mix a sufficient amount of epoxy, No. 136 0016, or equivalent to make repair.

(NOTE: Observe cautions of manufacturer in handling.)

5. While the transmission case is still HOT, apply the epoxy to the area to be repaired.

(NOTE: Make certain the area to be repaired is fully covered.)

6. Allow cement to cure for three hours before starting engine.

7. Road test and check for leaks.

2. Oil Leaks

The precautions that must be observed to prevent fluid leaks are as follows:

1. Use new gaskets and O-ring seals whenever there

is a disassembly.

2. Use a very small amount of petrolatum to hold gaskets and thrust washers in place during assembly, or to seal gaskets. Never use gasket paste or shellac.

3. Make sure that composition cork and paper gaskets are not wrinkled or creased when installed. Make sure that gaskets have not stretched or shrunk during storage.

4. Make sure the square type O-ring seals are installed squarely and are not twisted during assembly.

5. Make sure that mating surfaces of castings are flat and smooth, free of deep scratches, chips, and burrs.

6. Torque bolts to proper torque.

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

If oil leak is found to be in transmission, check for leak in following areas:

a. Front End

It will be necessary to remove lower cover at front of transmission case to determine location of leaks at front end. To correct leaks at front end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, Note 12, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case square cut O-ring or gasket damaged.

3. Rubber coated-washers on pump attaching screws damaged or missing.

4. Converter - Inspect converter for indications of leakage. See Note 13, for checking procedure.

5. Pump drain back hole not open (Fig. 7-11).

b. Extension Housing

1. Extension housing oil seal not installed properly or damaged.

2. Gasket (extension housing-to-case) improperly installed or damaged.

3. Extension housing-to-case attaching screws not torqued to specifications. Tighten to 23 foot-pounds.

4. Porous or cracked casting.

5. Propeller shaft front slip yoke scratched or corroded.

6. O-ring on output shaft, improperly installed or damaged.

c. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.

2. Speedometer driven gear housing O-ring or lip seal damaged.

3. Governor cover attaching screws not tight. Tighten screws to 18 foot-pounds.

4. Damaged governor gasket.

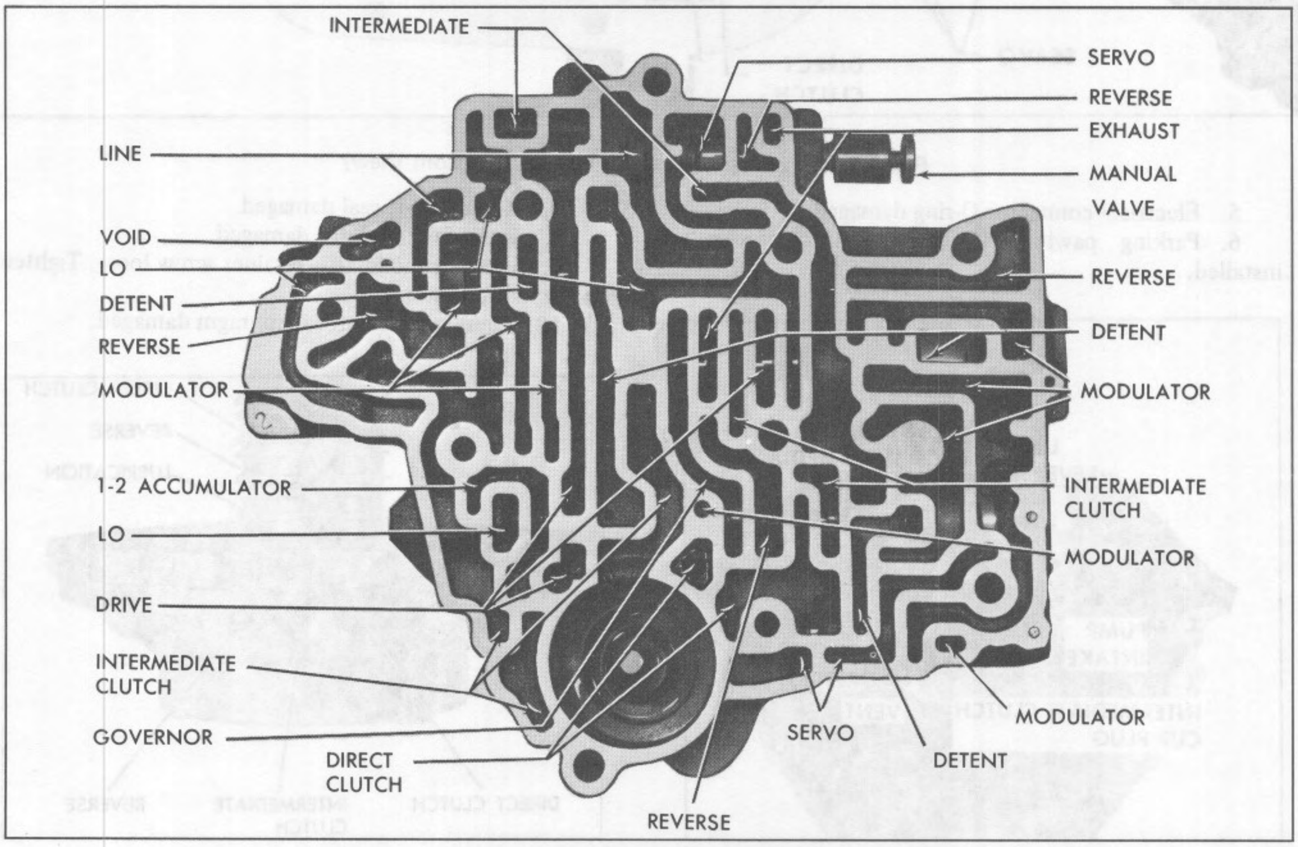


Fig. 7-7 Control Valve Body Oil Passages

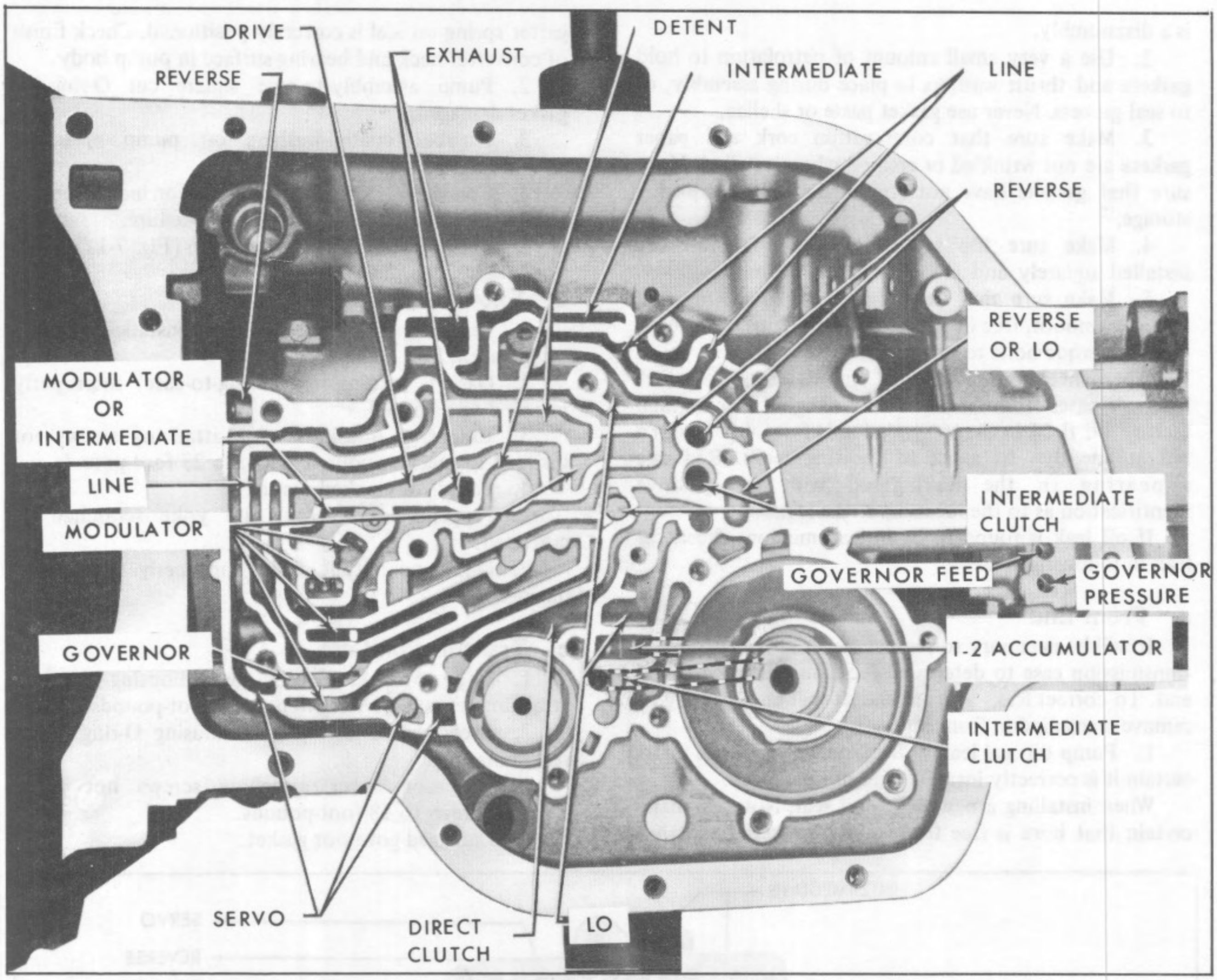


Fig. 7-8 Transmission Case Oil Passages (Bottom View)

5. Electrical connector O-ring damaged.
6. Parking pawl shaft cup plug not properly installed.
7. Manual shaft seal damaged.
8. Vacuum modulator damaged.
9. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.
10. Vacuum modulator diaphragm damaged.

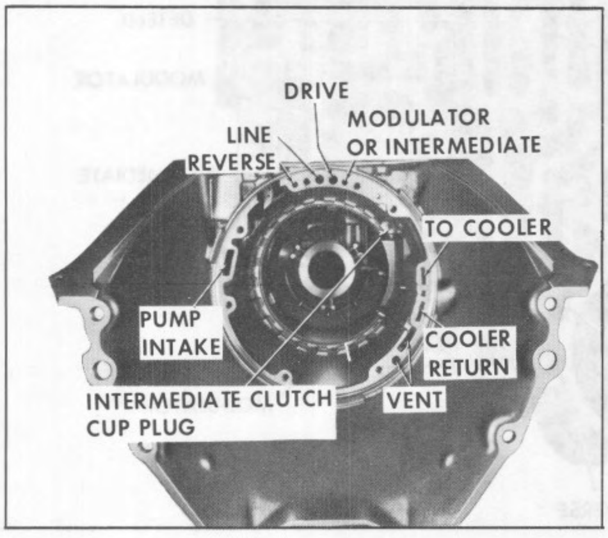


Fig. 7-9 Transmission Case Oil Passages

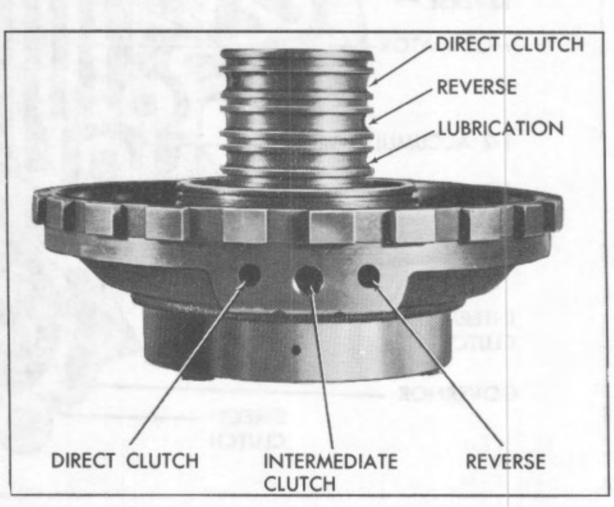


Fig. 7-10 Center Support Oil Passages

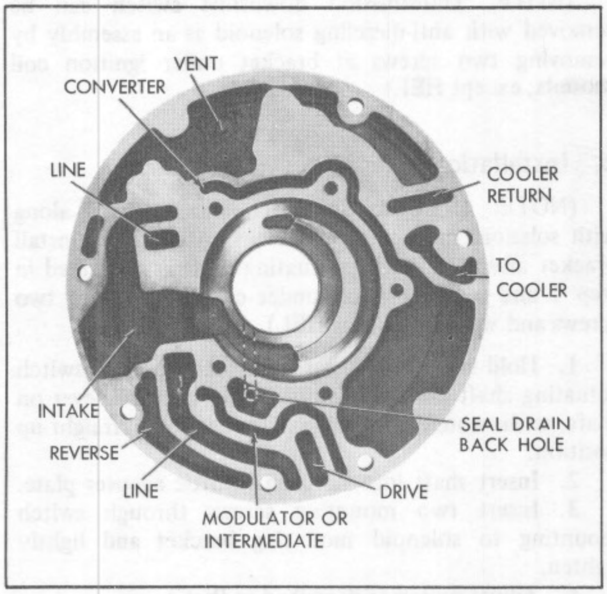


Fig. 7-11 Pump Body Oil Passages

(NOTE: A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion. Oil level of transmission will also be low with no visible external leak.)

11. Bottom pan gasket damaged.
12. Bottom pan attaching screws loose. Tighten to 12 foot-pounds.
13. Line pressure plug not tight. Tighten to no more than 10 foot-pounds.
14. Porous or cracked casting.
15. Vent pipe.
   a. Transmission over-filled.
   b. Water in oil.
   c. Pump to case gasket mispositioned.
   d. Foreign material between pump and case, or between pump cover and body.
   e. Case - Porous pump face improperly machined.
   f. Pump - Shy of stock, porous. Breather hole in pump cover plugged, Fig. 7-12.
   g. Cut O-ring or intake or grommet on filter assembly.

d. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.
2. Oil cooler pipe connections not tight. Tighten to 20 foot-pounds.
3. Flare on oil cooler pipes damaged at radiator or transmission.

e. Leaking Out Filler Pipe

1. O-ring damaged or improperly installed on pipe.
2. Filler pipe not fully seated in case.

f. Blowing Out Filler Pipe

1. Transmission over-filled.

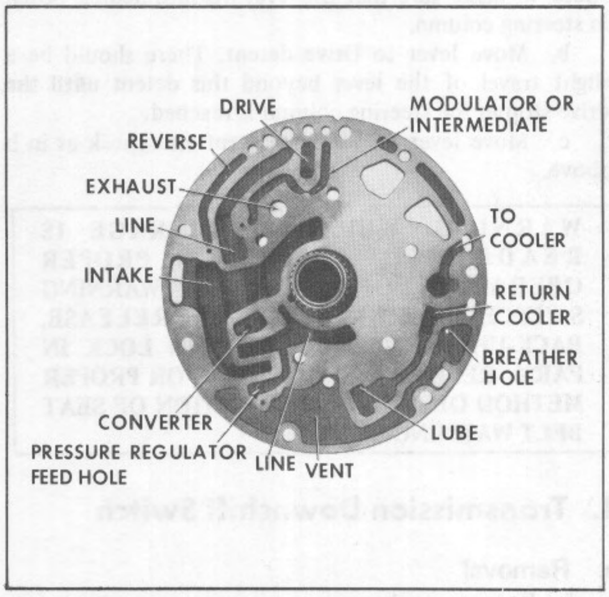


Fig. 7-12 Pump Cover Oil Passages

2. Plugged vent cap.
3. Plugged vent hole in pump.
4. Damaged pump gasket.
5. Engine overheating.

g. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.

1. Governor pipes damaged.
2. Rear servo cover attaching screws not tight. Tighten to 18 foot-pounds.
3. Rear servo cover gasket damaged.
4. Control valve assembly spacer plate-to-case gasket damaged.
5. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.
6. Solenoid gasket damaged.
7. Solenoid attaching screws loose. Tighten to 10 foot-pounds.
8. Intake pipe O-ring or filter grommet damaged causing a foaming condition.
9. Rear servo square cut O-ring improperly installed or damaged.

3. Manual Linkage Adjustments (Fig. 7-13)

1. Loosen adjusting nut on steering column shift rod to trunnion assembly swivel.
2. Working under car, pull trunnion lever up to position transmission shift valve in Park, then pull lever down to the third (Neutral) step. Make sure lever is centered in this detent position.
3. Position selector lever in Neutral detent in steering column.
4. Tighten relay rod to trunnion swivel adjusting nut.
5. Check operation of selector lever by performing the following steps:
   a. Lift lever and move to neutral detent. (This is the detent in the transmission.) Release the lever and

check to make sure that the lever fits into neutral notch in steering column.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

WARNING: WHENEVER LINKAGE IS READJUSTED, CHECK FOR PROPER OPERATION OF SEAT BELT WARNING SWITCH, PARKING BRAKE RELEASE, BACK-UP LIGHTS AND COLUMN LOCK IN PARK. REFER TO SECTION 12 FOR PROPER METHOD OF CHECKING FUNCTION OF SEAT BELT WARNING SWITCH.

4. Transmission Downshift Switch

a. Removal

1. Remove air cleaner.
2. Disconnect wire connectors.
3. Remove downshift switch.

(NOTE: Transmission downshift switch can be removed with anti-dieseling solenoid as an assembly by removing two screws at bracket under ignition coil mounts, except HEI.)

b. Installation

(NOTE: If downshift switch was removed along with solenoid mounting bracket as an assembly, install bracket after positioning actuating shaft as described in step 1 and secure bracket under coil mount with two screws and washers, except HEI.)

1. Hold switch in on-car position and rotate switch actuating shaft clockwise until it stops. Install lever on shaft with notch on inside and lever in straight-up position.
2. Insert shaft into hole on throttle adapter plate.
3. Insert two mounting screws through switch mounting to solenoid mounting bracket and lightly tighten.
4. Adjust switch as described in Part c.
5. Connect wires to terminals on switch.
6. Replace air cleaner.

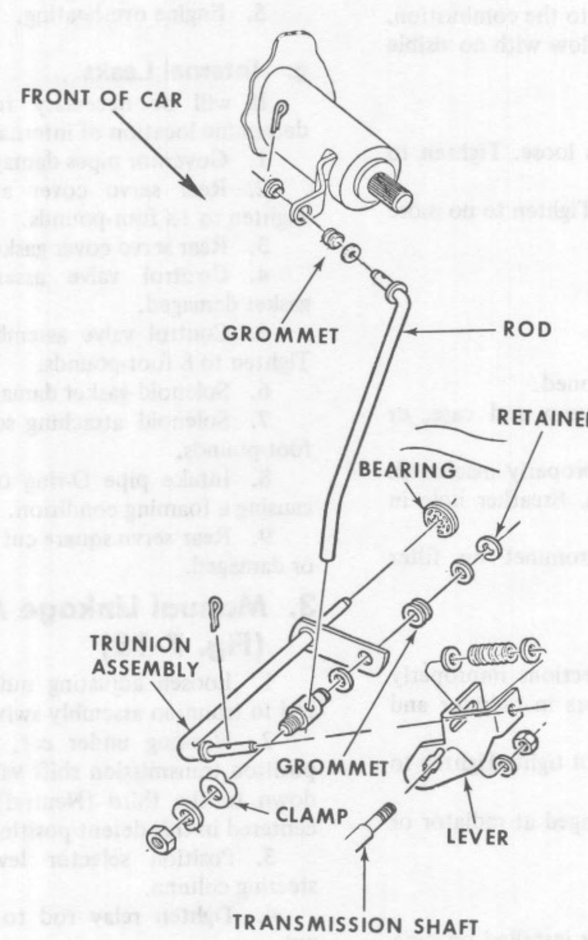


Fig. 7-13 Transmission Linkage

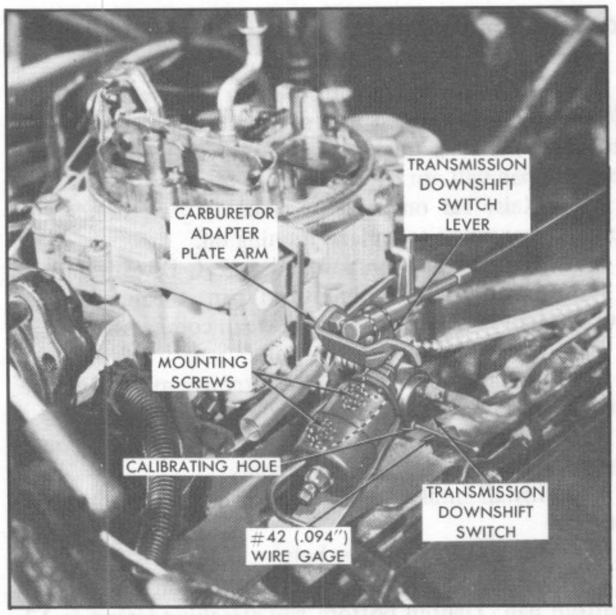


Fig. 7-14 Downshift Switch Adjustment

c. Adjustment

1. Remove carburetor air cleaner.
2. Make certain that carburetor is adjusted to specification and that throttle linkage is at low speed idle setting.
3. Loosen two mounting screws and insert a #42 (.094") wire gage size drill into the calibrating hole below lower wire terminal, Fig. 7-14. Adjust position of switch so that lever just touches the carburetor adapter plate arm (stud on 6L).

With this adjustment the downshift switch should make contact above 60° throttle.

4. With swtich positioned, tighten mounting screws and remove #42 (.094") gage from calibrating hole through switch.
5. Repeat step 3, if necessary.
6. Install air cleaner.

5. Checking and Adding Fluid

(NOTE: When checking fluid level the oil temperature and having the car on a level surface are particularly important. Careful attention to the following procedures is necessary in order to determine the actual fluid level.)

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added, use only DEXRON ® or DEXRON®-II type transmission fluid, or fluids of equivalent quality that have been especially formulated and tested for use in the Turbo Hydra-matic transmission.

The transmission dipstick and filler tube is located under the hood at the right rear top of the engine.

Under normal driving conditions, the transmission filter and fluid should be changed every 100,000 miles. If the car is driven extensively in heavy city traffic during hot weather, or is used to pull a trailer, change fluid every 50,000 miles. Likewise, operators of cars in commercial use (such as taxi-cab or limousine service) where the engine idles for long periods, should change fluid every 50,000 miles.

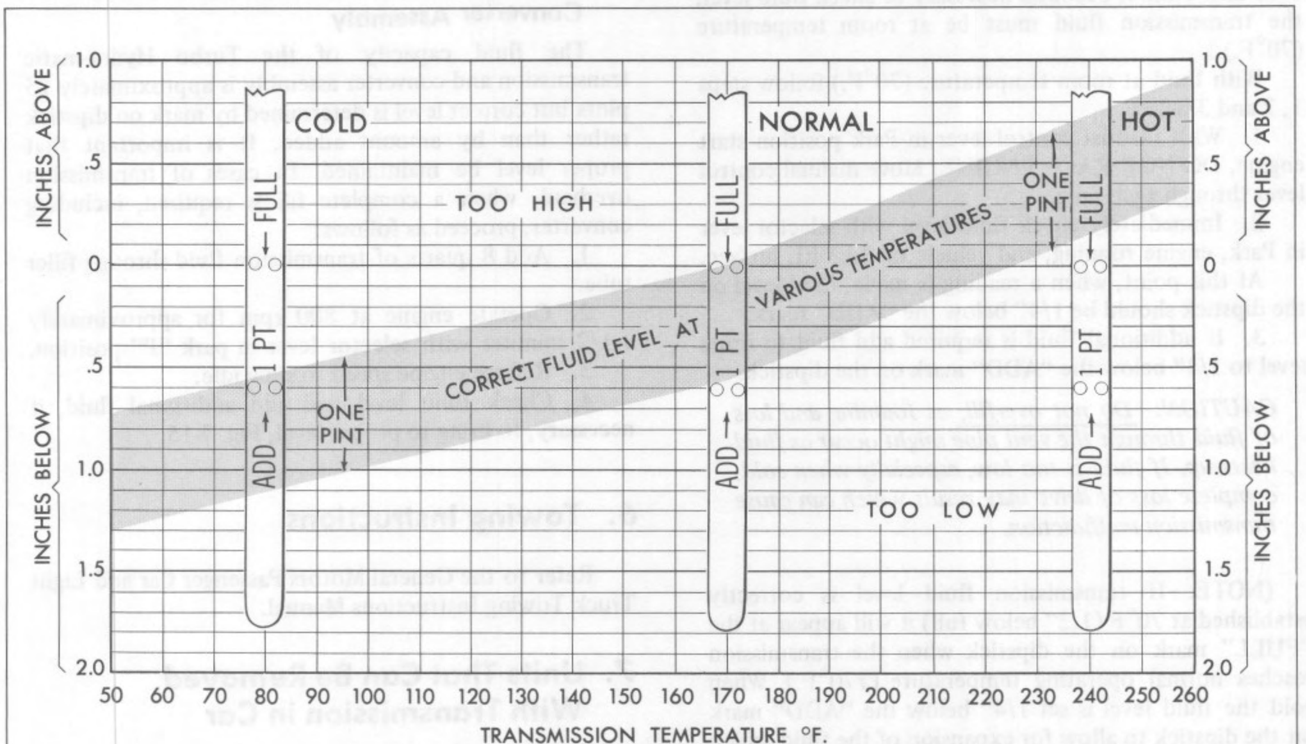


Fig. 7-15 Transmission Oil Level (Except Eldorado)

In any case of a major transmission malfunction, the filter assembly must be replaced. In addition, the oil cooler and cooler lines should be flushed, before adding new fluid.

b. Checking and Adding Fluid

Fluid level should be checked at every engine oil change. The full "F" and "ADD" dimple marks on the transmission dipstick indicate one pint difference. Correct fluid level is determined at normal operating temperature (170°F.). Careful attention to transmission oil temperature is necessary, as proper fluid level at low operating temperatures will be below the "ADD" mark on the dipstick, Fig. 7-15, and proper fluid level at high operating temperatures will be above the "ADD" mark Fluid level must always be checked with car on level surface, and with engine running to make certain converter is full. To determine proper fluid level, proceed as follows:

(NOTE: The full mark on the dipstick is an indication of transmission fluid at normal operating temperature of 170°. This temperature is only obtained after several miles of stop-and-go driving.)

1. With manual control lever in Park position start engine. DO NOT RACE ENGINE. Move manual control lever through each range.
2. Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be at the "FULL" mark.

3. If additional fluid is required, add fluid to bring the fluid level to the "FULL" mark on the dipstick.

If vehicle is not driven 15 expressway miles or equivalent, and it becomes necessary to check fluid level, the transmission fluid must be at room temperature (70°F.).

With fluid at room temperature (70°F.) follow steps 1, 2 and 3 below.

1. With manual control lever in Park position start engine. DO NOT RACE ENGINE. Move manual control lever through each range.
2. Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be 1/4" below the "ADD" mark.

3. If additional fluid is required add fluid to bring level to 1/4" below the "ADD" mark on the dipstick.

CAUTION: Do not overfill, as foaming and loss of fluid through the vent pipe might occur as fluid heats up. If fluid is too low, especially when cold, complete loss of drive may result which can cause transmission malfunction.

(NOTE: If transmission fluid level is correctly established at 70°F (1.2" below full) it will appear at the "FULL" mark on the dipstick when the transmission reaches normal operating temperature (170°F.). When cold the fluid level is set 1/4" below the "ADD" mark on the dipstick to allow for expansion of the fluid which occurs as transmission temperatures rise to normal operating temperature of 170°F.)

c. Draining Bottom Pan and Replacing Intake Pipe and Filter Assembly

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the filler tube. Remove 2 quarts of transmission fluid so that bottom pan will not overflow when removed.
2. Raise car on hoist or place on jack stands and provide container to collect draining oil.
3. Remove bottom pan and gasket. Discard gasket.
4. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.
5. Remove filter retainer bolt.
6. Remove intake pipe and filter assembly. Remove and discard intake pipe O-ring and filter.
7. Install new intake pipe O-ring onto pipe and install intake pipe into filter assembly.
8. Install intake pipe and filter assembly into case bore.
9. Install filter retainer bolt
10. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.
11. Lower car and add 4 quarts of transmission fluid through filler tube when replacing intake pipe O-ring seal and filter assembly. When draining bottom pan only add 2 quarts of transmission fluid.
12. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
13. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level, Fig. 7-15.

d. Adding Fluid to Fill Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 25 pints but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 8 quarts of transmission fluid through filler tube.
2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
3. Reduce engine speed to slow idle.
4. Check fluid level and add additional fluid, if necessary, to bring to proper level, Fig. 7-15.

6. Towing Instructions

Refer to the General Motors Passenger Car and Light Truck Towing Instructions Manual.

7. Units That Can Be Removed With Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

While the detailed procedure for removing each of the units, other than the extension housing and oil seal, and pressure regulator valve, is not outlined separately, the procedures covered under the transmission disassembly and assembly notes will apply.

a. Extension Housing
Removal - Note 9a
Installation - Note 9a
Oil Seal Replacement - Note 8

b. Pressure Regulator Valve
Removal - Note 10a
Installation - Note 10a

c. Vacuum Modulator and Valve
Removal - Note 14
Installation - Note 53

d. Governor Assembly
Removal - Note 15
Disassembly - Note 34
Installation - Note 54

e. Speedometer Driven Gear Assembly or Trackmaster Speed Sensor
Removal - Note 16
Disassembly - Note 35
Installation - Note 55

f. Intake Pipe and Filter Assembly and Bottom Pan
Removal - Note 17
Installation - Note 56 or Note 5C.

g. Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly
Removal - Note 18
Disassembly - Note 36
Installation - Note 52

h. Rear Servo Assembly
Removal - Note 19
Disassembly - Note 37
Installation - Note 51

i. Downshift Solenoid, Solenoid Connector, Control Valve Spacer and Gaskets, Check Balls, and Front Servo Assembly
Removal - Note 21
Front Servo Disassembly - Note 38
Installation - Note 50

j. Detent Lever, Manual Shaft, and Parking Linkage
Removal - Note 25
Installation - Note 48

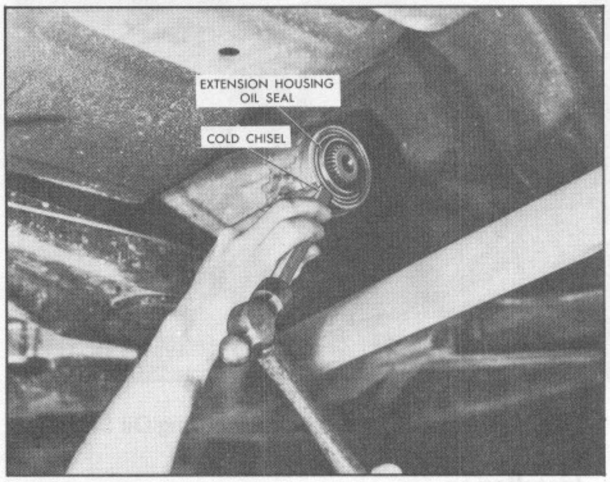


Fig. 7-16 Removing Extension Housing Oil Seal

8. Extension Housing Oil Seal Replacement (Transmission in Car)

1. Raise car on hoist or place on jack stands. Inspect leak to determine if cause is O-ring or housing seal.
2. Remove propeller shaft assembly as described in Section 4, Note 26a or 27a.
3. Use hammer to drive chisel under lip of oil seal and pry seal out of housing, Fig. 7-16.
4. Install new extension housing oil seals onto Oil Seal Installer J-21359.
5. Apply sealer supplied with new seal to outside of seal and install seal in extension housing using Oil Seal Installer, J-21359, Fig. 7-17.
6. Install propeller shaft assembly as described in Section 4, Note 26b or 27b.
7. Lower car to floor and add fluid to transmission as required.

9. Extension Housing Removal and Installation (Transmission in Car)

a. Removal

1. Raise car on hoist or place on jack stands. Provide container to catch oil.
2. Remove propeller shaft assembly as described in Section 4, Note 26a or 27a.
3. Remove rear engine mount to extension housing attaching screws.
4. Place jack under bottom oil pan. Use a block of wood to prevent damage to pan and raise transmission to lift extension housing off rear engine mount.
5. Remove six extension housing attaching screws and slide extension housing rearward and downward to remove from car. Make certain that output shaft splines do not come in contact with extension housing oil seal, as splines could damage seal lip.
6. Remove and discard O-ring from output shaft.

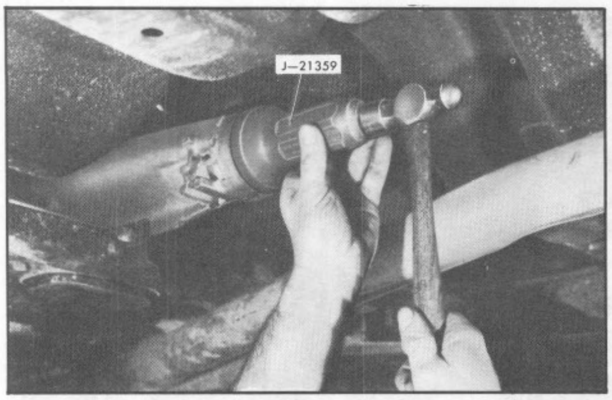


Fig. 7-17 Installing Extension Housing Oil Seal

b. Installation

1. Install gasket on extension housing.
2. Install new O-ring on output shaft and grease O-ring and splines with specified lubricant.
3. Carefully install extension housing over output shaft and against transmission case. Do not permit output shaft to contact oil seal as splines could damage seal lip.
4. Install six extension housing to case attaching screws, tightening screws to 23 foot-pounds.
5. Lower transmission onto rear engine mount.
6. Install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.
7. Remove jack from bottom of oil pan.
8. Install propeller shaft assembly as described in Section 4.
9. Lower car to floor and add fluid to transmission as required.

10. Pressure Regulator Valve Removal and Installation (Transmission in Car)

a. Removal

CAUTION: The solid type pressure regulator valve does not contain oil holes and an orifice cup plug like the previous type pressure regulator valve. The solid style valve must only be used in the pump cover with the squared off pressure regulator boss, (pressure boost bushing end). See Fig. 7-19. The previous pressure regulator valve with the oil holes and orifice cup plug will be used to service either type pump cover.

1. Raise car on hoist or place on jack stands. Provide container to catch oil.
2. Remove bottom pan and gasket. Drain oil.
3. Remove the filter retaining bolt and lift out pump intake pipy and filter assembly.
4. Remove and discard intake pipe O-ring and bottom pan gasket.
5. Using a screwdriver, steel rod or Tool J-24684 compress regulator boost valve bushing against pressure regulator spring, Fig. 7-18.

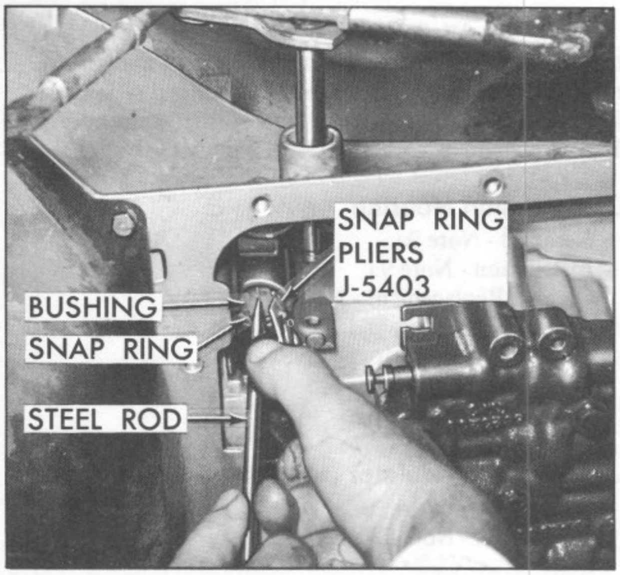


Fig. 7-18 Removing and Installing Pressure Regulator Valve

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED AND WILL FORCE VALVE BUSHING OUT OF BORE WHEN SNAP RING IS REMOVED IF VALVE BUSHING IS NOT HELD SECURELY.

6. Continue to exert pressure on valve bushing and remove snap ring, using Snap Ring Pliers, J-5403 (#21). Gradually release pressure on valve bushing until all spring force is exhausted.
7. Carefully remove regulator boost valve bushing and valve, and pressure regulator spring. Be careful not to drop parts, as they will fall out if they are not held.
8. Remove pressure regulator valve and spring retainer. Remove spacers if present. Be careful not to drop pressure regulator valve when removing it from bore.

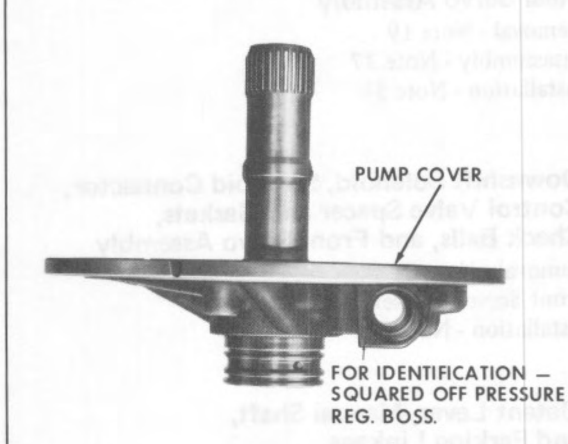


Fig. 7-19 Solid Type Pressure Regulator Valve

b. Installation

1. Install spring retainer on pressure regulator spring. Also install spacers if previously removed.

2. Install pressure regulator valve on spring, stem end first.

3. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.

4. Install complete assembly into pressure regulator valve bore, being careful not to drop parts during installation.

5. Using a screwdriver, steel rod or tool J-24684 compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-18.

(NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring upward into ring groove in valve bore.)

6. Install new intake pipe O-ring onto intake pipe and install intake pipe and filter assembly into transmission case bore, retaining filter with retainer bolt.

7. Install new gasket on bottom pan and install bottom pan.

8. Install thirteen bottom pan attaching screws. Tighten screws to 12 foot-pounds.

9. Lower car to floor and add fluid to transmission as required.

11. Transmission Removal and Installation

a. Removal

1. Disconnect negative battery cable.

2. Raise car on hoist.

3. Disconnect transmission linkage by removing one nut from shaft on left side of transmission.

4. Remove speedometer drive cable and disconnect trackmaster electrical harness, if so equipped. Disconnect downshift solenoid connector at case.

5. Disconnect oil cooler pipes at transmission using an open end wrench to hold fitting and a tubing wrench or a crowfoot adapter to remove tube nut. Cap pipes and plug connector holes in transmission. Position oil cooler pipes out of way.

6. Disconnect vacuum pipe hose from vacuum modulator and position vacuum pipe out of way.

7. Remove two screws that hold starter motor to engine block. Remove starter motor bracket and slide starter forward.

8. Remove propeller shaft as described in Section 4.

9. Remove lower flywheel housing cover.

10. Remove three converter to flywheel attaching bolts.

CAUTION: This is done by inserting a heavy screwdriver in open slot under one of the weld nuts on the converter, and rotating converter and flywheel until bolts can be reached for removal. Do not pry on flywheel ring gear or transmission case to rotate converter, as flywheel or case might be damaged. A bolt in the end of the crankshaft balancer can also be used to rotate the flywheel.

11. Place jack or other suitable device under rear of engine.

12. Remove two rear engine mount to extension housing screws.

13. Position transmission jack under transmission and raise it just enough to take the load off rear engine support.

14. Remove four bolts, two each side, from rear engine support and swivel support out of position. Allow support to hang by parking brake cable.

15. Remove six transmission case to engine attaching screws. It may be necessary to lower engine and transmission slightly to gain access to upper attaching screws.

16. Move transmission toward rear of car, disengaging transmission case from locating dowels on engine, install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20 and lower transmission from car.

CAUTION: Converter holding clamp must be used when removing transmission, otherwise converter can fall out when transmission is removed.

17. Remove Converter Holding Clamp from transmission case and remove converter.

CAUTION: Converter with oil weighs approximately 50 pounds. Be careful not to drop or damage converter when removing it.

b. Installation

1. Install converter on turbine shaft making certain that converter drive hub is fully engaged with pump gear tangs, and install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20.

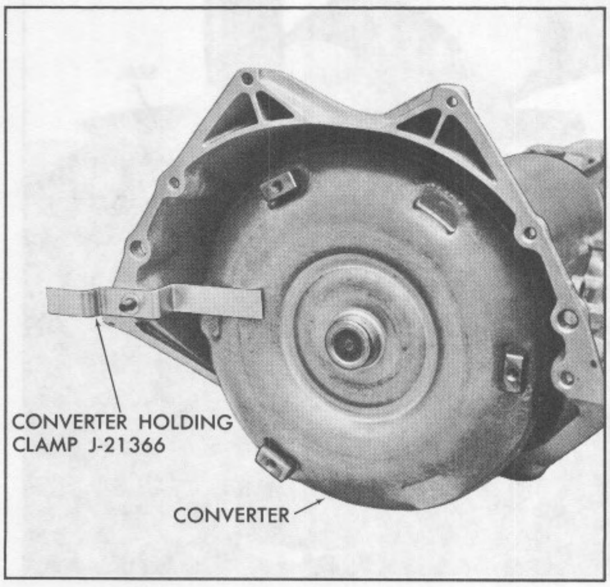


Fig. 7-20 Installing Converter Holding Clamp

2. Place transmission on transmission jack and carefully raise into position. Remove Converter Holding Clamp.

3. Align front of transmission case with engine and dowel holes in transmission case with dowels on engine. Install six transmission case to engine attaching screws, tighten screws to 35 foot-pounds.

CAUTION: The procedure for attaching the converter to the flywheel as described in Steps 4 through 6 must be strictly followed. Any deviation from this procedure may result in improper installation and damage to flywheel and transmission.

4. Rotate converter until two of the three weld nuts on converter line up with two bolt holes in flywheel. Make certain converter rotates freely in this position and is not cocked and that pilot in center of converter is properly seated in crankshaft.

5. Install two flywheel to converter attaching bolts through accessible bolt holes in flywheel and tighten finger tight. Bolts must not be tightened at this time to assure proper alignment of converter.

6. Insert screwdriver under converter weld nut, rotate converter and install third attaching bolt. Tighten all bolts to 30 foot-pounds.

7. Install lower flywheel housing cover screws tightening screws to 5 foot-pounds.

8. Position starter motor to engine block and install two screws, tightening screws to 46 foot-pounds. Starter harness heat shield and starter ground strap should be installed under outboard screw. Route starter harness inside heat shield.

9. Install starter motor front bracket, tightening screws to 12 foot-pounds.

10. Raise engine and transmission above normal height and swivel rear engine support into position. Install two bolts on each side, tighten bolts to 30 foot-pounds.

11. Lower transmission carefully and install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.

12. Remove jacks.

13. Install speedometer cable and downshift solenoid electrical harness to transmission case. Connect trackmaster harness if vehicle is so equipped.

14. Install transmission linkage to shaft and secure with one nut.

15. Install vacuum hose on modulator, making sure modulator pipe is fully engaged with modulator.

16. Clean ends of oil cooler pipes with solvent and connect pipes to transmission using an open end wrench to hold fitting and a tubing wrench or a crowfoot adapter to tighten tube nut.

17. Install propeller shaft as described in Section 4, Note 26b and 27b.

18. Lower car and connect negative battery cable.

19. Add fluid to transmission as required.

20. Check operation of manual linkage. Adjust, if necessary as described in Note 3.

12. Pump Oil Seal Replacement

1. Remove transmission assembly from car as described in Note 11a.

2. Use hammer to drive chisel under lip of oil seal and pry seal out of pump body, Fig. 7-21.

3. Before installing new seal, make certain bore is free from foreign material and that garter spring on seal is correctly positioned. Also check finish of converter neck and bearing surface in pump body.

(NOTE: Use a non-hardening sealer on outside of seal body before installing seal.)

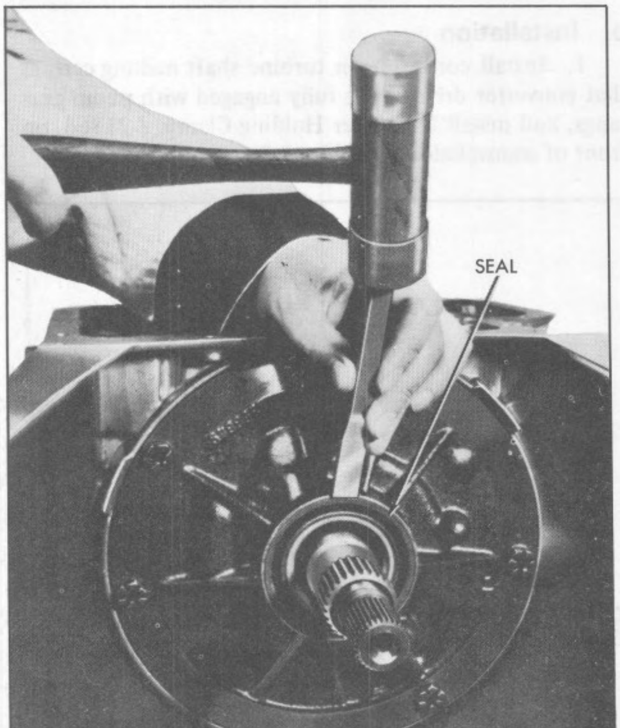


Fig. 7-21 Removing Pump Oil Seal

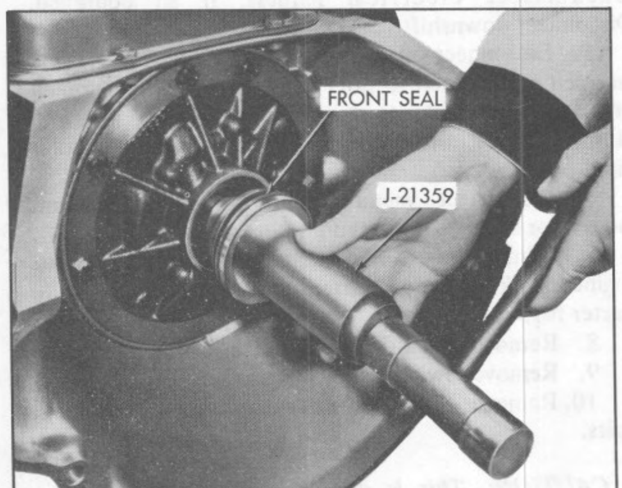


Fig. 7-22 Installing Pump Oil Seal

4. Install new seal in pump body using Pump Oil Seal Installer, J-21359, Fig. 7-22.

5. Install transmission assembly in car as described in Note 11b.

MAJOR TRANSMISSION COMPONENTS—REMOVAL

13. Converter

1. Remove transmission from car as described in Note 11a and remove converter from transmission.

2. Perform visual inspection as follows:

a. Inspect converter for visual signs of damage.

b. Inspect for wrong converter.

c. Inspect neck of converter for wear.

d. Inspect pump drive slots for signs of excessive wear.

3. Insert valve, part of Converter Leak Test Fixture, J-21369, in neck of converter and back-off large hex nut.

4. Install leak test fixture band crosswise on converter so that slotted plate fits around valve and under nut, Fig. 7-23. Tighten nut to expand O-ring and secure a good seal.

5. Apply compressed air with a service air hose until approximately 80 to 100 psi air pressure is obtained.

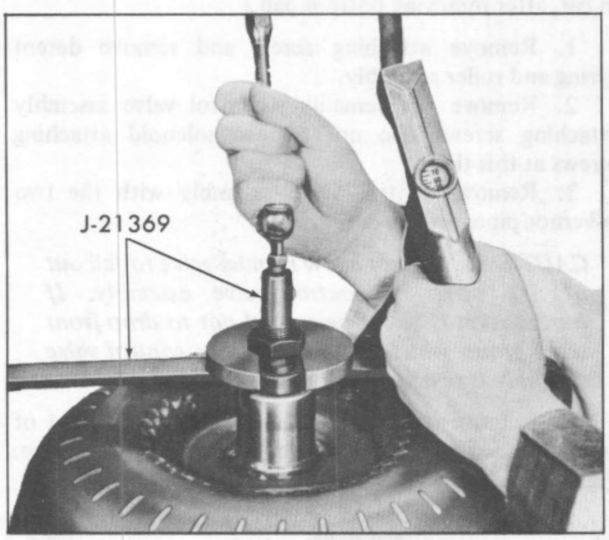


Fig. 7-23 Leak Checking Converter

6. Immerse assembly in water, noting any sign of bubbles that would indicate a leak.

7. Depress valve stem to release air pressure in converter and then remove leak test fixture band and valve.

WARNING: ALWAYS RELEASE AIR PRESSURE BEFORE REMOVING VALVE, AS A DEFINITE HAZARD EXISTS SHOULD VALVE BLOW OUT DURING REMOVAL.

8. Thoroughly dry converter and install converter in transmission as follows:

a. Place transmission in Holding Fixture, J-8763-01 and install Holding Fixture in Holding Fixture Base, J-3289-20, so that transmission is positioned vertically with pump end up.

b. Carefully position converter on turbine shaft, making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.

c. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.

d. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.

9. Install transmission as described in Note 11b.

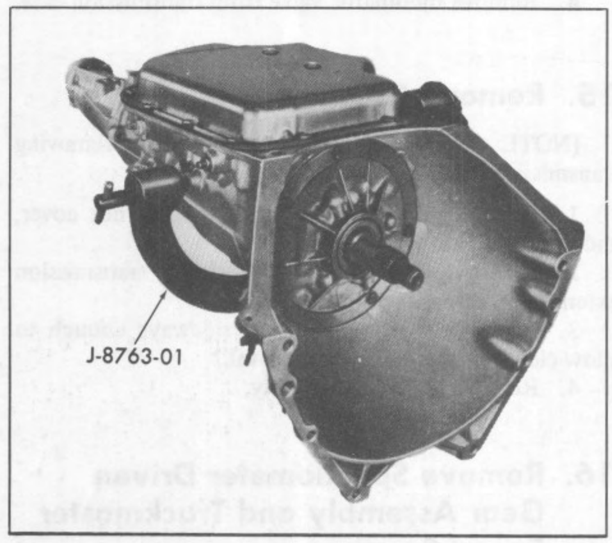


Fig. 7-24 Transmission in Holding Fixture

(NOTE: On the following operations when the transmission is out of car remove converter from transmission and install Holding Fixture, J-8763-01, on transmission so that vacuum modulator will be located on side of Holding Fixture nearest the bench. Install fixture and transmission into Holding Fixture Base, J-3289-20, with bottom pan facing up, Fig. 7-24, and install lock pin in base. Provide container to catch any oil that may drain from transmission.)

14. Remove Vacuum Modulator and Valve

(NOTE: Unit may be removed without removing transmission or bottom pan.)

1. Remove vacuum hose from modulator.

2. Remove vacuum modulator attaching screw and retainer from transmission case.

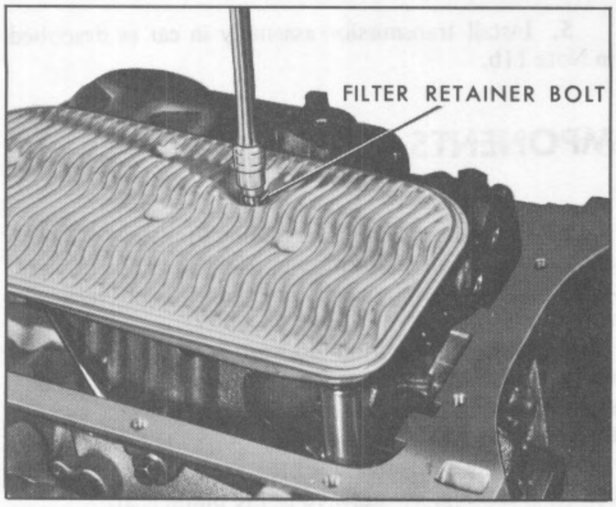


Fig. 7-25 Removing Filter Retaining Bolt

3. Remove modulator assembly and O-ring from case. Discard O-ring.
4. Remove modulator valve from transmission case.

15. Remove Governor Assembly

(NOTE: Unit may be removed without removing transmission or bottom pan.)

1. Remove four attaching screws, governor cover, and gasket. Discard gasket.
2. Remove two bolts attaching transmission extension housing to cross member.
3. Move rear of transmission sideways enough to allow clearance for governor removal.
4. Remove governor assembly.

16. Remove Speedometer Driven Gear Assembly and Trackmaster Speed Sensor

(NOTE: Unit may be removed without removing transmission or bottom pan, after removing speedometer cable from driven gear assembly.)

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove unit and speedometer driven gear.

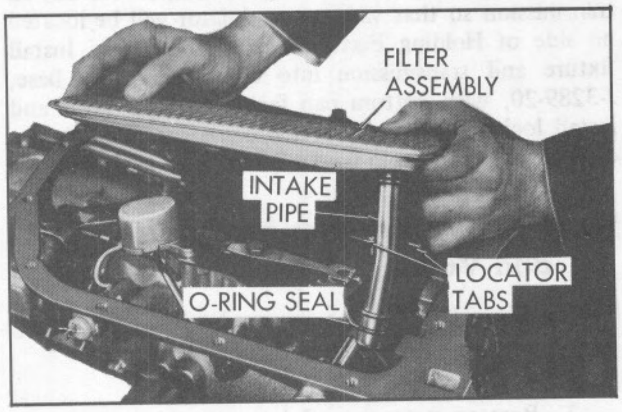


Fig. 7-26 Removing Intake Pipe and Filter Assembly

17. Remove Intake Pipe and Filter Assembly and Bottom Pan

(NOTE: Unit may be removed with transmission in car. In cases of transmission malfunction, filter must be replaced.)

1. Remove bottom pan attaching screws.
2. Remove bottom pan and gasket. Discard gasket. Drain oil from pan if transmission is in car.
3. Remove filter retainer bolt, Fig. 7-25.
4. Lift out pump intake pipe and filter assembly, Fig. 7-26.
5. Remove intake pipe from filter and discard filter.
6. Remove and discard intake pipe O-ring.

18. Remove Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly

(NOTE: Units may be removed with transmission in car, after removing bottom pan.)

1. Remove attaching screw and remove detent spring and roller assembly.
2. Remove ten remaining control valve assembly attaching screws. Do not remove solenoid attaching screws at this time.
3. Remove control valve assembly with the two governor pipes attached, Fig. 7-27.

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly. If transmission is in car be careful not to drop front servo group which may drop out as control valve assembly is removed.

4. Remove governor screen assembly from end of governor feed pipe or governor feed pipe hole in case. Fig. 7-28. Clean screen in clean solvent and air dry.

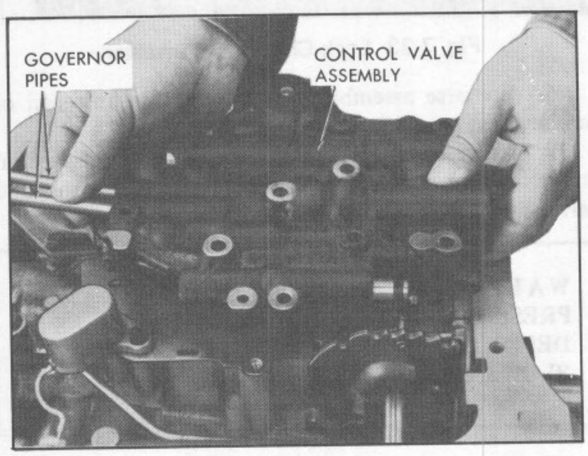


Fig. 7-27 Removing Control Valve Assembly

5. Remove governor pipes from valve body. Governor pipes are interchangeable and need not be identified.

19. Remove Rear Servo Assembly

(NOTE: Unit may be removed with transmission in car after removing bottom pan and allowing fluid to drain. Remove control valve assembly, and governor pipes (Note 18.)

1. Remove six rear servo cover attaching screws, servo cover, and gasket. Discard gasket.
2. Remove rear servo assembly from transmission case, Fig. 7-29.
3. Remove servo accumulator spring.
4. Make band apply pin selection check (Note 20) to determine proper size pin to use at time rear servo is assembled.

20. Band Apply Pin Selection Check

(NOTE: Check may be made with transmission in car. Remove bottom pan and allow fluid to drain. Remove control valve assembly, governor pipes (Note 18 and rear servo Note 19.)

1. Position Band Apply Pin Selector Gage, J-21370-6, on transmission case over rear servo bore, with hex nut on side of gage facing toward parking brake linkage, and smaller diameter end of Gage Pin, J-21370-5, in servo pin bore, Fig. 7-30.
2. Secure gage with two 5/16-18 x 1 inch screws, tightening screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up and down in both tool and servo pin bore. Stepped side of pin must face front of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

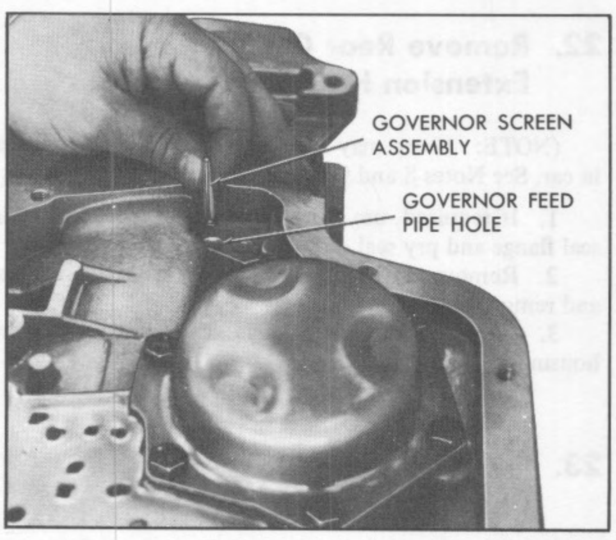


Fig. 7-28 Removing Governor Screen Assembly

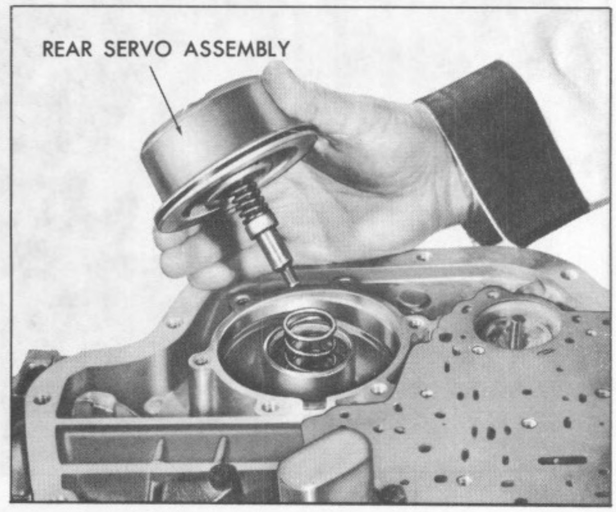


Fig. 7-29 Removing Rear Servo Assembly

IDENTIFICATION	LENGTH
Three Rings	Long
Two Rings	Medium
One Ring	Short

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

3. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage, Fig. 7-30. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is between

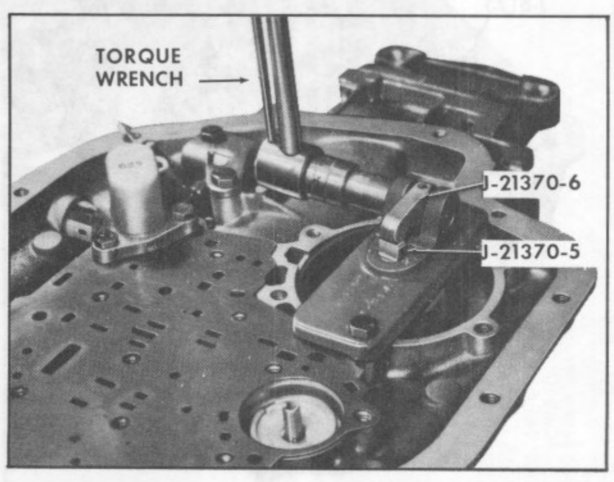


Fig. 7-30 Band Apply Pin Selection Check

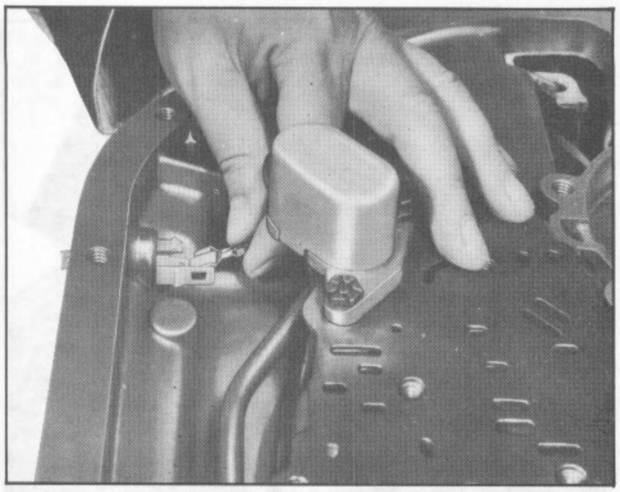


Fig. 7-31 Removing Wire From Electrical Connector

upper and lower steps on gage pin, medium size pin (two rings) is required.

c. If machined surface on top of gage is even with or below step on gage pin, short size pin (one ring) is required.

4. If new pin is required, make note of pin size required, and remove gage from transmission case.

21. Remove Detent Solenoid, Solenoid Connector, Control Valve Spacer, Gaskets, Check Balls, and Front Servo Assembly

(NOTE: Units may be removed with transmission in car. Remove bottom pan and drain transmission fluid).

To remove control valve spacer, gasket, check balls, and front servo, remove control valve assembly and governor pipes Note 18.

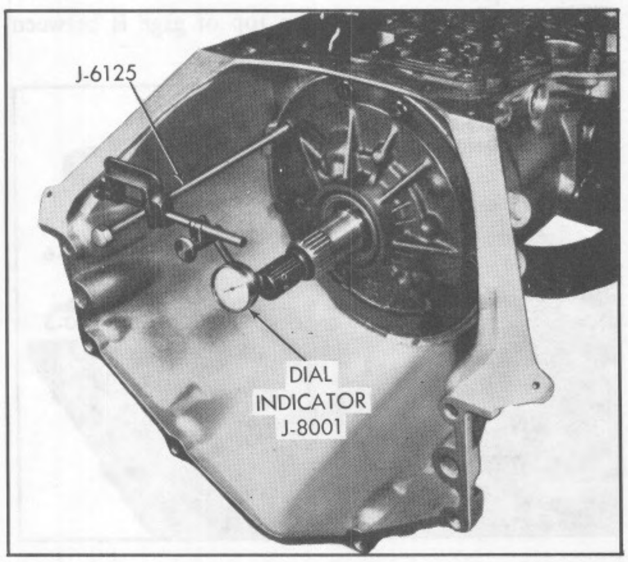


Fig. 7-32 Front Unit End Play Check

Fig. 7-33 Removing Pump Assembly

1. Disconnect detent solenoid wire from electrical connector terminal, see Fig. 7-31.

2. Compress tabs on case connector and remove connector and O-ring from case. Discard O-ring.

3. Remove two detent solenoid attaching screws and remove solenoid assembly and gasket.

4. Remove control valve spacer plate from case.

(NOTE: If operation is being performed on car, lower control valve spacer plate in a level plane so that check balls don't fall out. Then remove check balls from spacer plate.)

5. Remove six check balls from cored passages in transmission case.

6. Lift front servo piston, retainer ring, pin, spring retainer, and spring out of transmission case.

22. Remove Rear Oil Seal and Extension Housing

(NOTE: Units may be removed with transmission in car. See Notes 8 and 9.)

1. If required, use hammer to drive chisel under oil seal flange and pry seal out of extension housing.

2. Remove six extension housing attaching screws and remove extension housing.

3. Remove and discard gasket from extension housing.

23. Front Unit End Play Checking Procedure

(NOTE: Transmission must be removed from car Note 11a.)

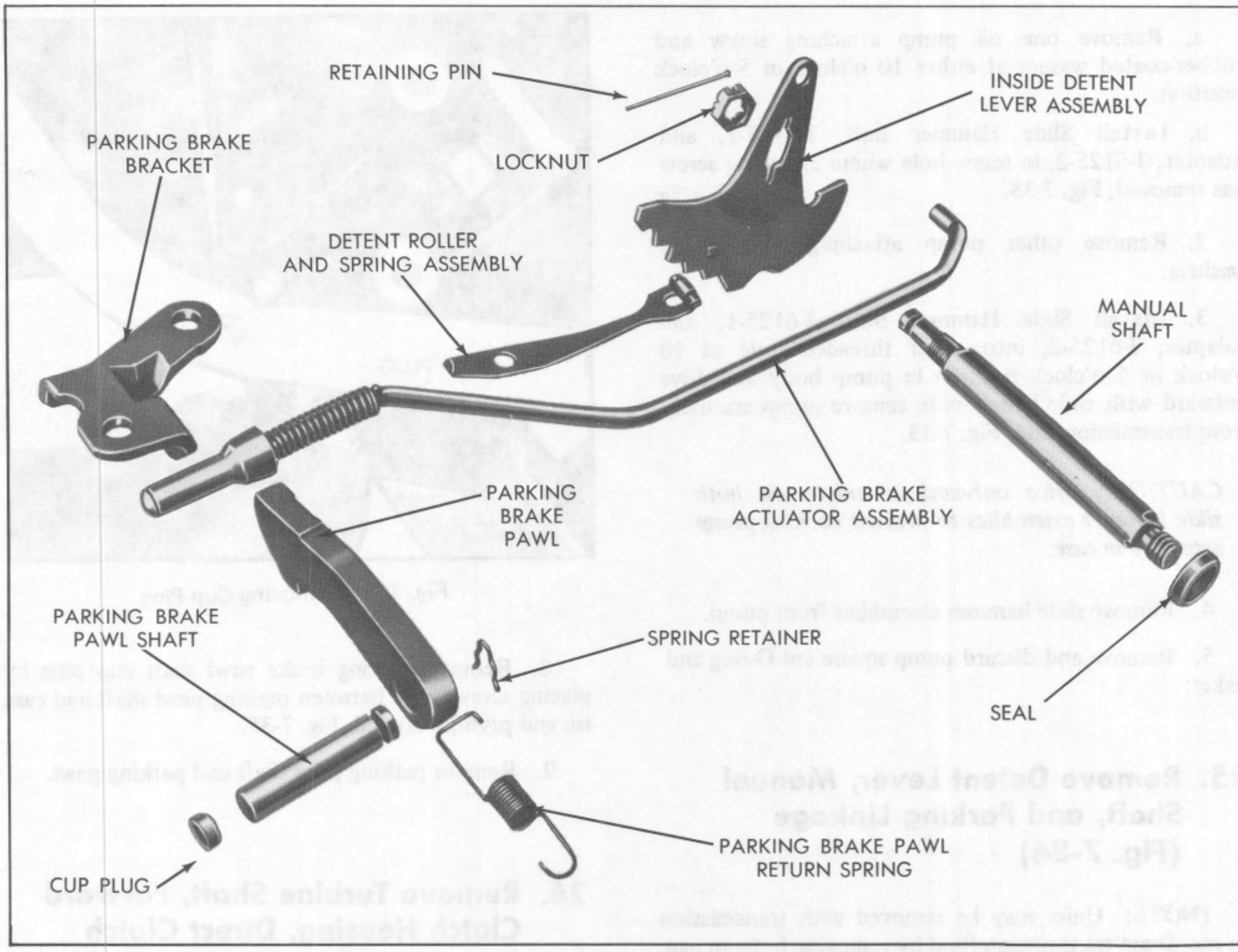


Fig. 7-34 Manual and Parking Linkage

1. Remove one oil pump attaching screw and rubber-coated washer at either 10 o'clock or 5 o'clock position.

2. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed.

3. Mount Dial Indicator, J-8001, on slide hammer bolt and index indicator to register with flat surface on end of turbine shaft.

4. Hold output shaft forward while pushing turbine shaft rearward to its stop.

5. Set dial indicator to zero.

6. Pull turbine shaft forward, Fig. 7-32.

Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .003 inch- .024 inch. The selective washer controlling this end play is the washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the following chart.

THICKNESS (INCH	COLOR
.060 .064	Yellow
.071 - .075	Blue
.082 - .086	Red
.093 - .097	Brown
.104 - .108	Green
.115 .119	Black
.126 - .130	Purple

(NOTE: An oil-soaked washer may tend to discolor. If necessary, measure washer for thickness.)

7. Remove dial indicator. If oil pump is to be removed, do not remove slide hammer assembly at this time.

24. Remove Oil Pump

(NOTE: For removing oil pump only, transmission must be removed from car Note 11a.)

1. If not done previously, perform the following steps:

a. Remove one oil pump attaching screw and rubber-coated washer at either 10 o'clock or 5 o'clock position.

b. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed, Fig. 7-33.

2. Remove other pump attaching screws and washers.

3. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, into other threaded hole at 10 o'clock or 5 o'clock position in pump body and drive outward with slide hammers to remove pump assembly from transmission case, Fig. 7-33.

CAUTION: Drive outward in unison on both slide hammer assemblies to prevent cocking pump assembly in case.

4. Remove slide hammer assemblies from pump.

5. Remove and discard pump square cut O-ring and gasket.

25. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-34)

(NOTE: Units may be removed with transmission in car. Drain transmission fluid by removing bottom pan. Remove manual linkage from manual lever and remove detent spring and roller assembly from control valve assembly.)

1. Remove pin securing manual shaft to case.

(NOTE: If procedure is being performed on car, bend pin to remove it.)

2. Loosen locknut securing inside detent lever to manual shaft.

3. Pry or work inside detent lever loose from manual shaft and remove locknut.

4. Remove manual shaft, parking actuator rod and detent lever from case. Inspect manual shaft lip seal as required.

5. Remove parking brake bracket attaching screws and remove bracket.

6. Remove parking pawl return spring.

(NOTE: The following steps are to be completed only if one or more of the parts involved require replacement.)

7. Remove spring retainer from parking pawl shaft.

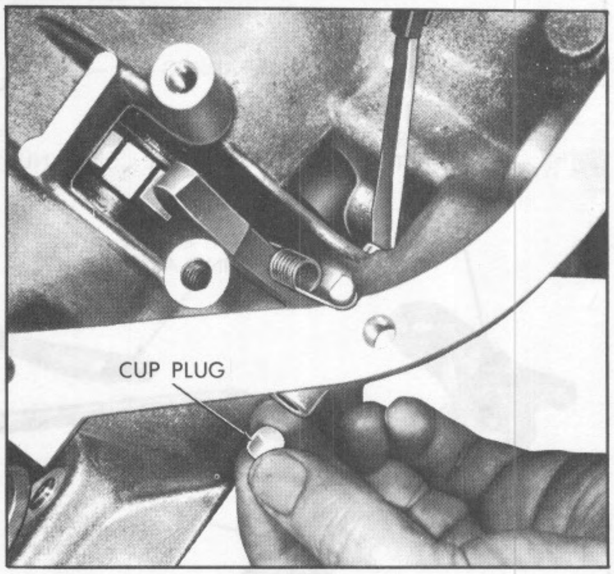


Fig. 7-35 Removing Cup Plug

8. Remove parking brake pawl shaft cup plug by placing screwdriver between parking pawl shaft and case rib and prying outward, Fig. 7-35.

9. Remove parking pawl shaft and parking pawl.

26. Remove Turbine Shaft, Forward Clutch Housing, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

(NOTE: Transmission must be removed from car, Note 11a. Requires removal of oil pump, Note 24.

1. Remove turbine shaft and forward clutch assembly from transmission, Fig. 7-36.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

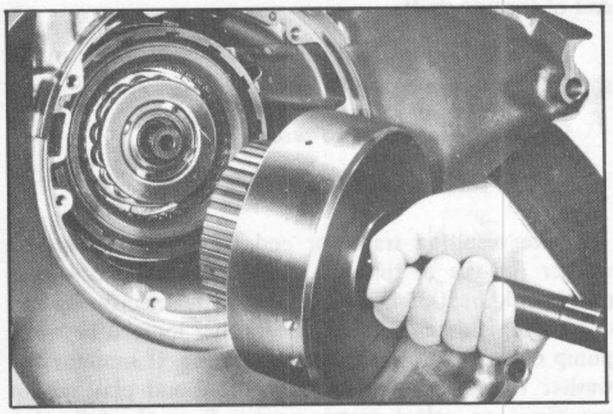


Fig. 7-36 Removing Forward Clutch Assembly

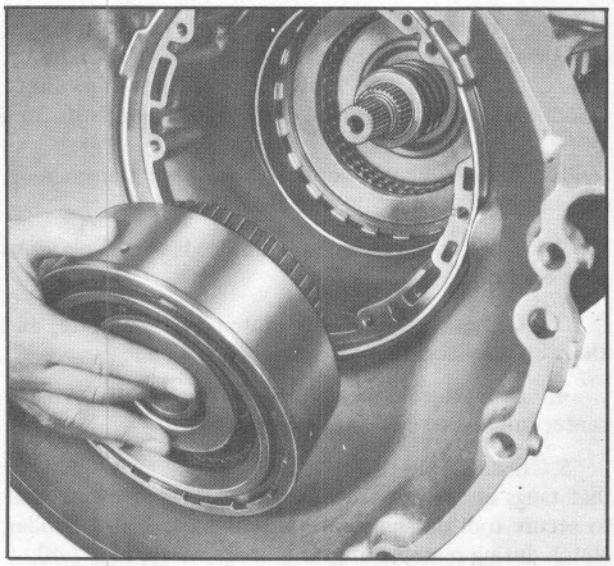


Fig. 7-37 Removing Direct Clutch and Intermediate Roller Assembly

3. Remove direct clutch and intermediate roller assembly, Fig. 7-37. Sun gear shaft may come out with direct clutch assembly.

4. Remove sun gear shaft if not previously removed. See Fig. 7-38.

5. Remove front band assembly.

(NOTE: Check rear unit end play at this time. Proceed as follows:)

27. Rear Unit End Play Checking Procedure

(NOTE: Transmission must be removed from car, Note 11a. Requires removal of extension housing.)

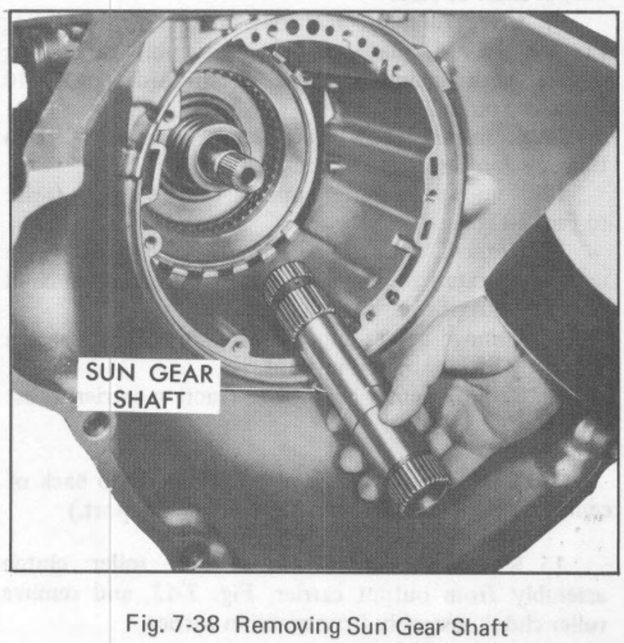


Fig. 7-38 Removing Sun Gear Shaft

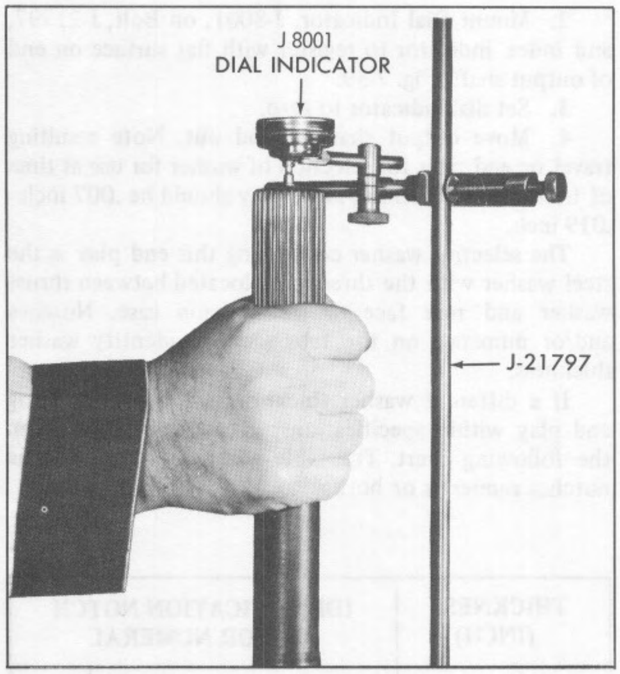


Fig. 7-39 Checking Rear Unit End Play

1. Install Speedometer Puller Bolt, J-21797, in one of the bolt holes on end of transmission case.

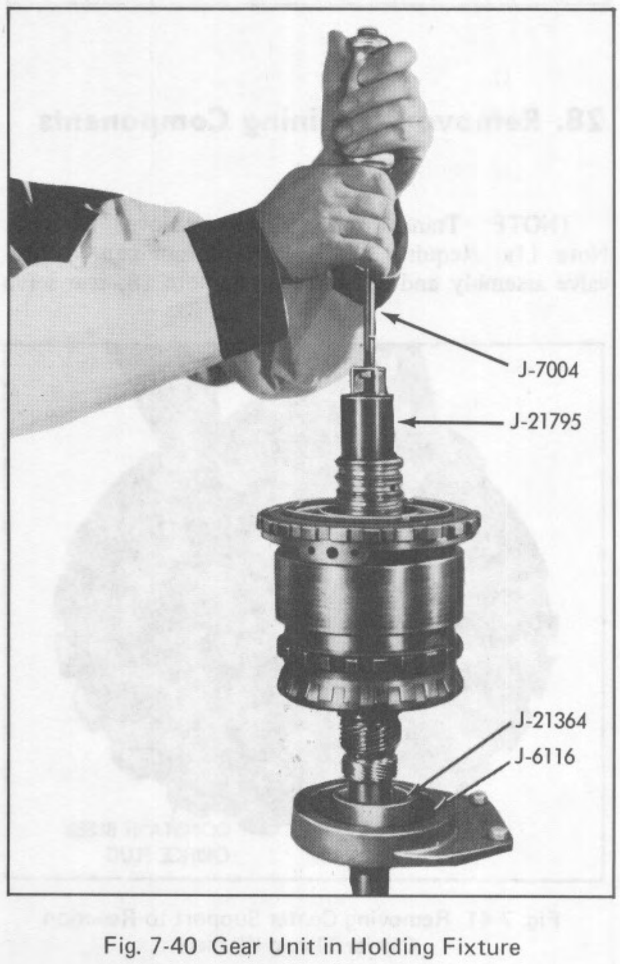


Fig. 7-40 Gear Unit in Holding Fixture

2. Mount Dial Indicator, J-8001, on Bolt, J-21797, and index indicator to register with flat surface on end of output shaft, Fig. 7-39.

3. Set dial indicator to zero.

4. Move output shaft in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .007 inch - .019 inch.

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches and/or numerals on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart. The table will show identification notches numerals or both.

THICKNESS (INCH)	IDENTIFICATION NOTCH AND/OR NUMERAL	
.074 - .078	None	1
.082 - .086	On Side of 1 Tab	2
.090 - .094	On Side of 2 Tabs	3
.098 - .102	On End of 1 Tab	4
.106 - .110	On End of 2 Tabs	5
.114 - .118	On End of 3 Tabs	6

28. Remove Remaining Components

(NOTE: Transmission must be removed from car Note 11a. Requires removal of bottom pan, control valve assembly and governor pipes Note 18, rear servo assembly Note 19, control valve spacer, two gaskets, check balls and front servo assembly Note 21, oil pump Note 24, turbine shaft forward clutch housing, direct clutch assembly, sun gear shaft and front band Note 26.)

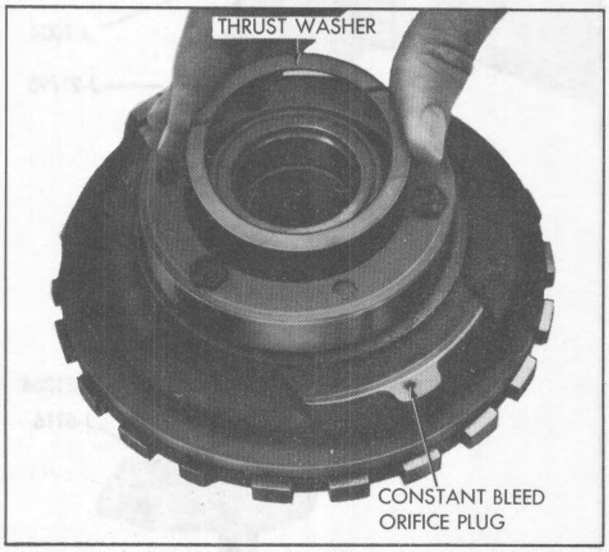


Fig. 7-41 Removing Center Support to Reaction Carrier Thrust Washer

1. Remove center support bolt from transmission case using 3/8 inch 12-point thin wall deep socket.

2. Remove intermediate clutch backing plate to case snap ring.

3. Remove intermediate clutch backing plate, and three composition and three steel clutch plates.

4. Using needle nose pliers, or screwdriver, remove center support to case snap ring.

5. Install Tool, J-21795, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of roller clutch during removal of gear unit assembly, Fig. 7-40.

6. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline damage to case bushing when removing gear unit, center support, and reaction carrier.

(NOTE: Loosen transmission holding fixture pivot pin slightly, so that gear unit assembly does not bind when it is removed from case.)

7. With transmission case in a horizontal position, shift complete assembly toward front of case to facilitate removal of assembly from case. Remove complete gear unit assembly from case.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal. This could result in damage to output shaft bushing in case as well as to assembly itself.

8. Remove output shaft to case thrust washer from output shaft or case.

9. Using Adapter. J-21364, in Rear Unit Holding Fixture, J-6116, place gear unit assembly in holding fixture with mainshaft pointing upward, Fig. 7-40 Remove Tool J-21795.

10. Remove rear unit selective washer from transmission case.

11. Remove the center support to case spacer (refer to Fig. 7-176.)

12. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.

13. Remove center support assembly from reaction carrier by lifting straight upward.

14. Remove center support to reaction carrier thrust washer, Fig. 7-41.

(NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.)

15. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-42, and remove roller clutch assembly from reaction carrier.

TRANSMISSION DISASSEMBLY, CLEANING, INSPECTION AND ASSEMBLY OF INDIVIDUAL UNITS

Inspect each part thoroughly after the transmission and individual units have been disassembled and cleaned, to determine which parts should be replaced. It is very important to distinguish between parts that are simply "worn-in" and those parts worn to the extent that they affect operation of the unit. Only "worn-out", broken or damaged parts should be replaced.

29. Inspection of Torque Converter

1. Check converter for leaks as described in Note 13.
2. Check converter hub surfaces for signs of scoring or wear.

30. Inspection of Vacuum Modulator and Valve

1. Inspect vacuum modulator for any signs of bending or distortion.
2. Inspect O-ring seat for damage.
3. Inspect modulator valve for nicks or damage.
4. Check freeness of valve operation in case bore.
5. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure. Use procedure outlined in Diagnosis Part V.

31. Inspection of Extension Housing

1. Inspect bushing and rear seal for excessive wear or damage.

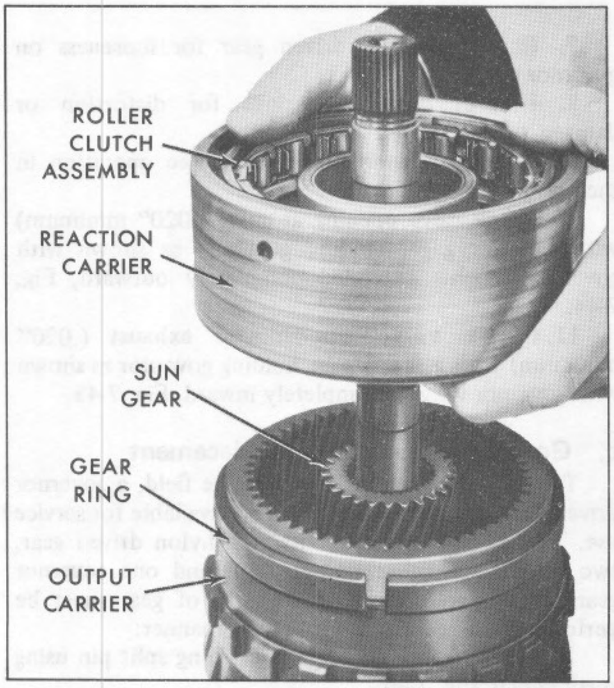


Fig. 7-42 Roller Clutch Assembly

2. Inspect gasket mounting face for damage.
3. Inspect housing for cracks or porosity.
4. Be sure rear seal drain back port is not blocked.

32. Inspection of Detent Lever, Manual Shaft, and Parking Linkage

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs.
2. Inspect actuator spring for damage.
3. Inspect actuator for a free fit on actuator rod.
4. Inspect parking pawl for cracks or wear.
5. Inspect manual shaft and lip seal for damage.
6. Inspect inside detent lever for cracks or a loose pin.
7. Inspect parking pawl return spring for deformed coils or ends.
8. Inspect parking bracket for cracks or wear.
9. Inspect detent spring and roller assembly.

33. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages, Fig. 7-8 and 7-9.
2. Check for good retention of band anchor pins.
3. Inspect all threaded holes for thread damage.
4. Inspect intermediate clutch driven plate lugs for damage or brinelling.
5. Inspect snap ring grooves for damage.
6. Inspect governor assembly bore for scratches or scoring.
7. Inspect modulator valve bore for scoring or damage.
8. Inspect cup plug inside case for good staking and sealing, Fig. 7-9.

CAUTION: If the case assembly requires replacement, make sure the center support to-case spacer is removed from the old case and reinstalled in the new case.

34. Governor Assembly (Fig. 7-43)

All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

It is necessary to disassemble the governor assembly in order to replace the driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

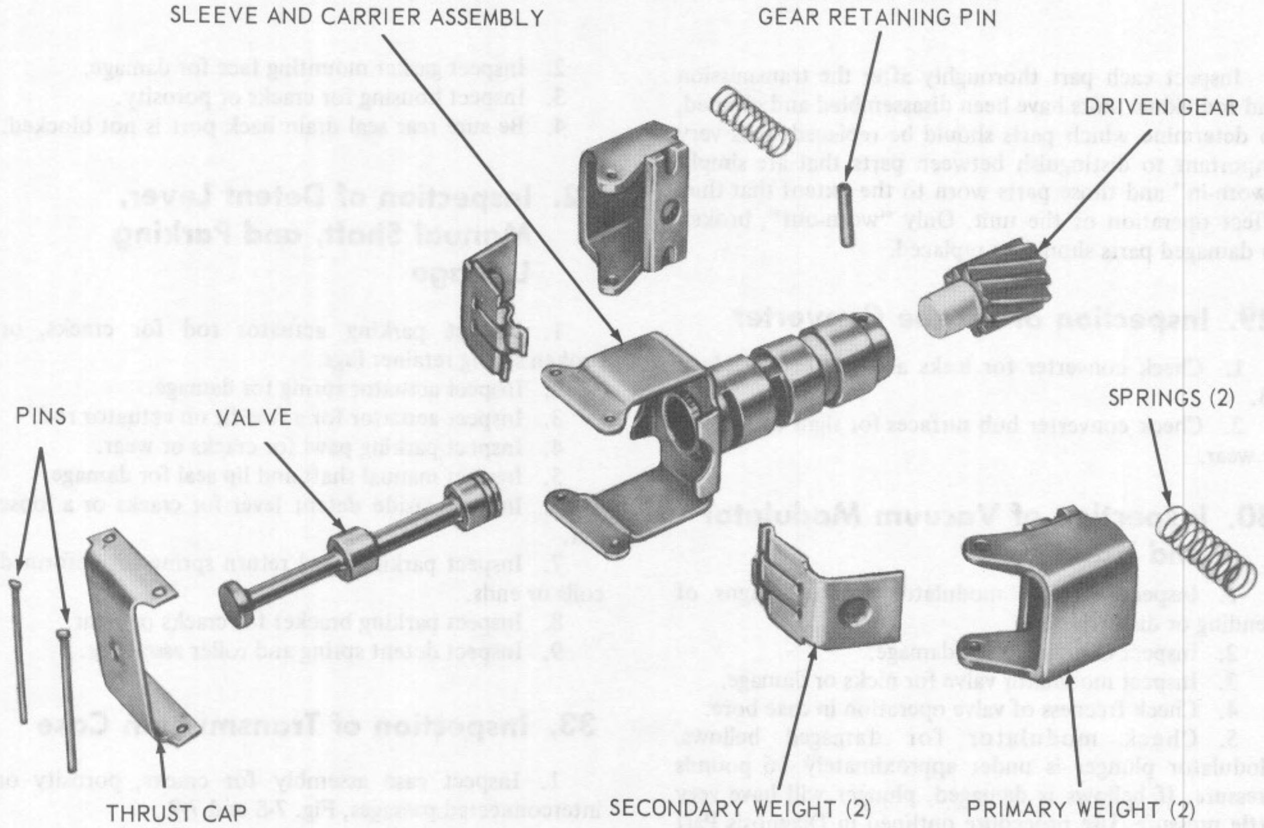


Fig. 7-43 Governor Assembly—Exploded View

a. Disassembly

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified.

2. Remove governor valve from governor sleeve. Be careful not to damage valve.

3. Perform the following inspections and replace governor driven gear if necessary.

b. Inspection

1. Wash all parts in cleaning solvent, air dry and blow out all passages.

2. Inspect governor sleeve for nicks, burrs, scoring and galling.

3. Check governor sleeve for free operation in bore of transmission case.

4. Inspect governor valve for nicks, burrs, scoring or galling.

5. Check governor valve for free operation in bore of governor sleeve.

6. Inspect governor driven gear for nicks, burrs, or damage.

7. Check governor driven gear for looseness on governor sleeve.

8. Inspect governor springs for distortion or damage.

9. Check governor weights for free operation in their retainers.

10. Check valve opening at entry (.020" minimum) with a feeler gage, holding governor as shown with governor weights extended completely outward, Fig. 7-44.

11. Check valve opening at exhaust (.020" minimum) with a feeler gage, holding governor as shown with governor weights completely inward, Fig. 7-45.

c. Governor Driven Gear Replacement

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch, Fig. 7-46.

2. Support governor on 3/16 inch plates installed in

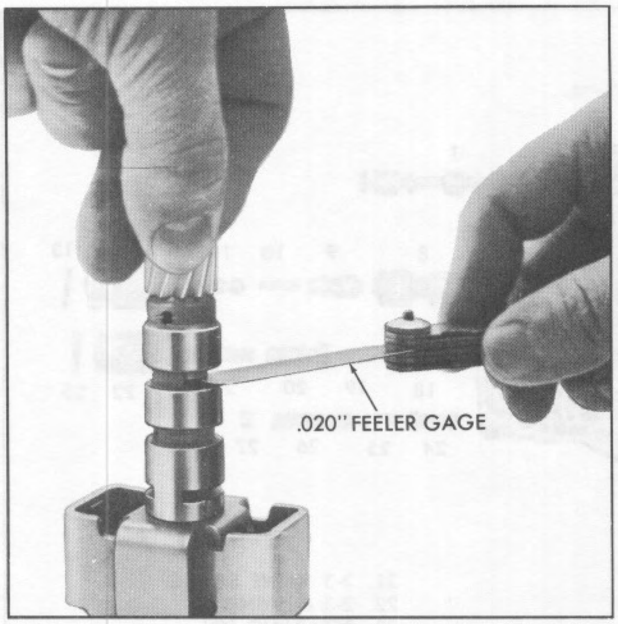


Fig. 7-44 Checking Valve Opening—Weights Extended

exhaust slots of governor sleeve, place in arbor press and, with a long punch, press gear out of sleeve.

3. Carefully clean governor sleeve of chips that remain from original gear installation.

4. Support governor on 3/16 inch plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch, and then while supporting governor in press, drill new hole through sleeve and gear using a 1/8 inch drill.

6. Install split retainer pin.

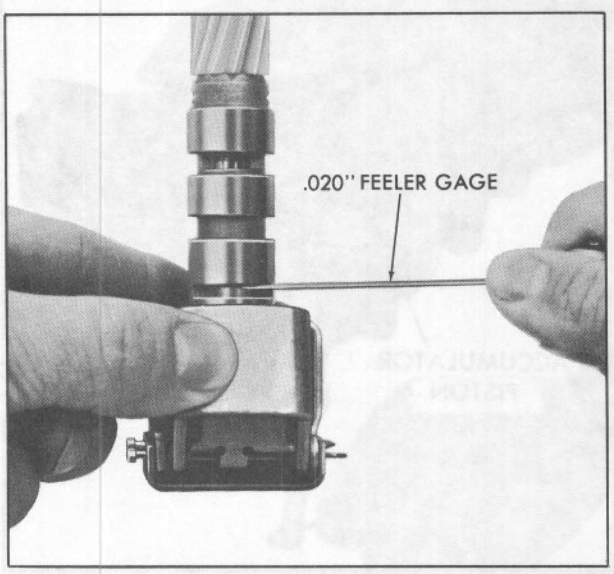


Fig. 7-45 Checking Valve Opening—Weights Inward

7. Wash governor assembly thoroughly to remove any chips that may have collected.

d. Assembly

1. Install governor valve in bore of governor sleeve.
2. Install governor weights and springs, and thrust cap on governor sleeve.
3. Align pin holes in thrust cap, governor weight assemblies, and governor sleeve, and install new pins. Crimp both ends of pins to prevent them from falling out.
4. Check governor weight assemblies for free operation on pins and valve for freeness in sleeve bore.

35. Speedometer Driven Gear Assembly and Transmission Speed Sensor

a. Disassembly

1. Remove speedometer driven gear from sleeve or sensor.
2. Remove O-ring from speedometer driven gear sleeve or sensor.
3. Remove C-wire ring retaining sleeve to gear lip seal.
4. Remove lip seal.

b. Inspection

1. Inspect gear for damaged teeth or shaft.
2. Inspect sleeve or sensor for scores, damaged threads or cracks.
3. Inspect seals for cuts or damage.
4. Inspect sensor for corrosion on wire terminal.

c. Assembly

1. Install sleeve to gear lip seal.

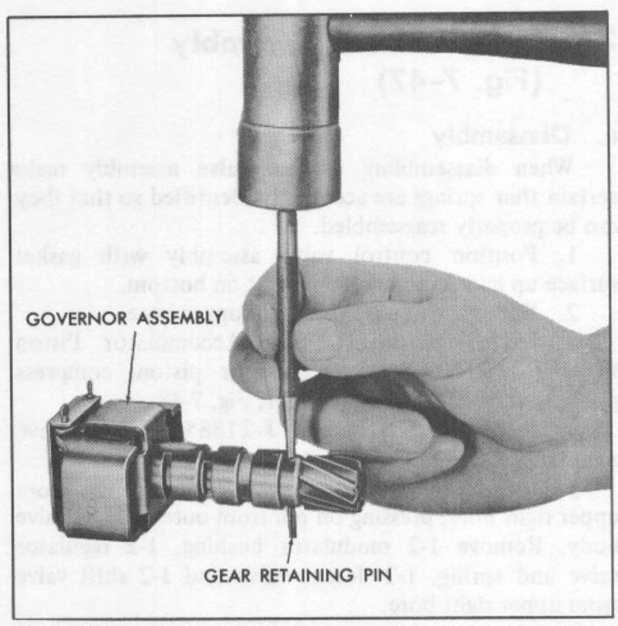
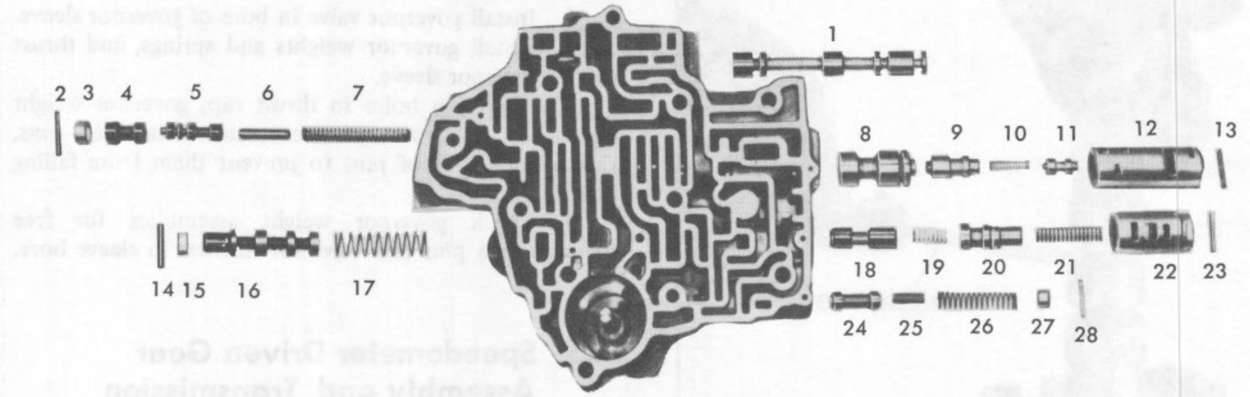


Fig. 7-46 Removing Governor Driven Gear Retaining Pin



1. MANUAL VALVE
2. RETAINING PIN
3. BORE PLUG
4. DETENT VALVE
5. DETENT REGULATOR
6. SPACER
7. DETENT SPRING
8. 1-2 VALVE
9. 1-2 DETENT VALVE
10. 1-2 REGULATOR SPRING
11. 1-2 REGULATOR VALVE
12. 1-2 BUSHING
13. RETAINING PIN
14. RETAINING PIN
15. BORE PLUG
16. 1-2 ACCUMULATOR VALVE
17. 1-2 ACCUMULATOR PRIMARY SPRING
18. 2-3 VALVE
19. 3-2 INTERMEDIATE SPRING
20. 2-3 MODULATOR VALVE
21. 2-3 VALVE SPRING
22. 2-3 BUSHING
23. RETAINING PIN
24. 3-2 VALVE
25. SPACER
26. 3-2 SPRING
27. BORE PLUG
28. RETAINING PIN

Fig. 7-47 Control Valve Assembly—Exploded View

2. Install C-wire retaining ring.
3. Install O-ring on speedometer driven gear sleeve.
4. Install gear in sleeve.

36. Control Valve Assembly (Fig. 7-47)

a. Diassembly

When diassembling control valve assembly make certain that springs are accurately identified so that they can be properly reassembled.

1. Position control valve assembly with gasket surface up and accumulator pocket on bottom.
2. Remove manual valve from upper bore.
3. Install Control Valve Accumulator Piston Installer, J-21885, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-48.
4. Remove Installer, J-21885, and remove accumulator piston and spring.
5. Using pin punch, remove retaining pin from upper right bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 regulator valve and spring, 1-2 detent valve and 1-2 shift valve from upper right bore.

(NOTE: 1-2 regulator valve and spring may be inside of 1-2 modulator bushing.)

6. Using punch, remove retaining pin from center right bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring,

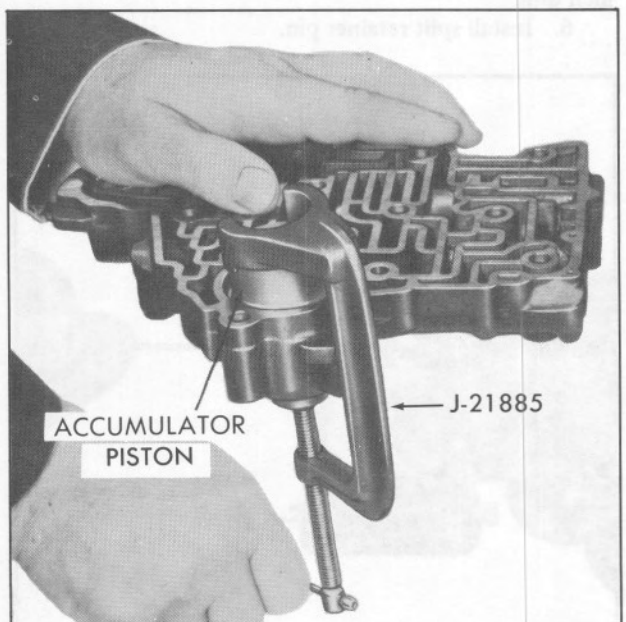


Fig. 7-48 Removing Front Accumulator Piston

2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from center right bore.

(NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.)

7. Using pin punch, remove retaining pin from lower right bore, pressing on pin from outer side of valve body.

CAUTION: Hold hand over bore when removing retainer pin as 3-2 valve spring may force bore plug out.

8. Remove bore plug, 3-2 valve spring, spacer and 3-2 valve from lower right bore.

9. Using pin punch, remove retainer pin from upper left bore by pressing on outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS DETENT REGULATOR VALVE SPRING MAY FORCE OTHER COMPONENTS OUT OF BORE.

10. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left bore.

11. Remove grooved retaining pin from lower left bore by prying out with long nose pliers.

12. Remove bore plug, 1-2 accumulator valve and primary spring from lower left bore.

b. Inspection

(NOTE: Do not remove the teflon oil seal ring from the front accumulator piston unless the oil seal ring

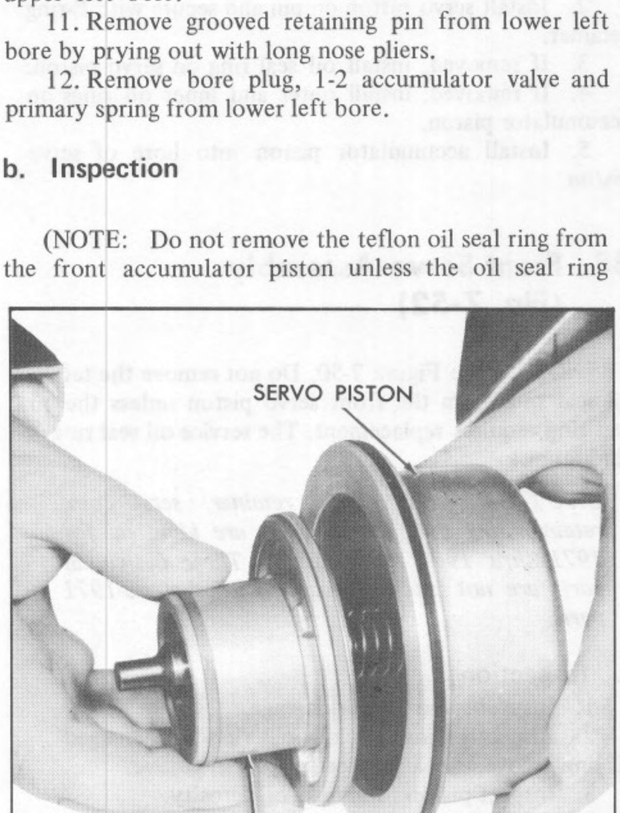


Fig. 7-49 Disassembling Rear Servo and Accumulator Piston

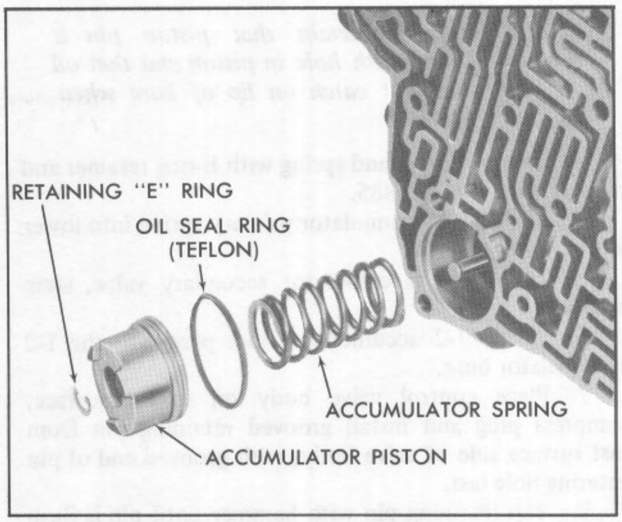


Fig. 7-50 Front Accumulator—Exploded View

requires replacement. The service oil seal ring is cast iron, Fig. 7-50.)

CAUTION: The type of front accumulator piston used in 1971 thru 1974 is not interchangeable with pre-1971 psiton.

1. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

2. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

3. All valves and bushings should be tested in their individual bores to make certain that free movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking, be careful to prevent valve damage in any way.

4. The manual valve is the only valve that can be serviced separately. If other valves are malfunctioning or damaged beyond repair, a new control valve assembly should be installed.

5. Inspect body for cracks or scored bores.

6. Check all springs for distortion or collapsed coils.

7. Inspect front accumulator piston and oil ring for damage.

c. Assembly

1. Position front accumulator spring and piston into valve body.

2. Install Control Valve Accumulator Piston Installer, J-21885, on piston. Compress spring and piston, aligning spring and piston with bore, Fig. 7-48.

CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

3. Secure piston and spring with E-ring retainer and remove Installer, J-21885.

4. Install 1-2 accumulator primary spring into lower left bore (Fig. 7-47).

5. Install 1-2 accumulator secondary valve, stem end out.

6. Install 1-2 accumulator bore plug into the 1-2 accumulator bore.

7. Place control valve body on gasket surface, compress plug and install grooved retaining pin from cast surface side of valve body, with grooved end of pin entering hole last.

8. Tap retaining pin with hammer until pin is flush with cast surface. Return control valve assembly to its original position.

9. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left bore, making certain spring seats in bottom of bore.

10. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.

11. Install detent regulator valve, stem end out, and detent valve, small land first, into upper left bore.

12. Insert bore plug, hole out, into upper left bore and, pressing inward on bore plug, remove screwdriver and install retaining pin from cored side of valve body.

13. Install 3-2 valve in bottom right bore.

14. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom right bore.

15. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with retaining pin from cored side of valve body.

16. Install 3-2 intermediate spring in open end of 2-3 shift valve, and install valve and spring, valve first, into center right bore. Make certain valve seats in bottom of bore.

17. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in center right bore.

18. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.

19. Install 1-2 shift valve, stem end out, in upper right bore, making certain valve seats in bottom of bore.

20. Install 1-2 regulator valve, larger stem first, spring and 1-2 detent valve, hole end first, into 1-2 bushing, and install in upper right bore of control valve body.

21. Compress bushing against spring and secure with retaining pin from cored side of control valve body.

22. Install manual valve with detent pin groove to the right.

37. Rear Servo Assembly (Fig. 7-51)

a. Disassembly

1. Remove rear accumulator piston from rear servo piston. See Fig. 7-49.

2. Remove E-ring retaining rear servo piston to band apply pin.

3. Remove rear servo piston and seal from band apply pin.

4. Remove washer, spring and retainer.

b. Inspection

1. Check freeness of oil seal rings in piston grooves.

(NOTE: See Fig. 7-51. Do no remove the teflon oil seal rings from the rear accumulator piston, unless the oil seal rings requires replacement.

If the teflon inner oil seal ring, (small diameter) requires replacement, for service, use the aluminum oil seal ring.

The rear accumulator piston, large diameter ring groove depth, is machined shallower to take the large teflon oil seal ring, if this requires replacement, use only the teflon oil seal ring.)

2. Inspect fit of band apply pin in servo piston.

3. Inspect band apply pin for scores or cracks.

4. Inspect band apply pin for proper size as determined by pin selection check (note 20.)

c. Assembly

1. Install spring retainer with cup side toward band apply servo pin, spring and washer on servo pin.

2. Install servo piston on pin and secure with E-ring retainer.

3. If removed, install oil seal ring on servo piston.

4. If removed, install outer and inner oil rings on accumulator piston.

5. Install accumulator piston into bore of servo piston.

38. Front Servo Assembly (Fig. 7-52)

(NOTE: See Figure 7-50. Do not remove the teflon oil seal ring from the front servo piston unless the oil seal ring requires replacement. The service oil seal ring is aluminum.)

CAUTION: The spring retainer, servo pin, retainer ring and servo piston are identical for 1971 thru 1974 transmissions. These individual parts are not interchangeable with the pre-1971 parts.

a. Inspection

1. Inspect servo pin for damage.

2. Inspect piston and oil seal ring for damaged oil ring groove, check freedom of ring in groove.

3. Inspect piston for cracks or porosity.

4. Check fit of servo pin in piston.

b. Assembly

1. Reassemble parts of front servo, making sure tapered end of servo pin is pointing through the spring and spring retainer. Make sure the retainer ring is in the servo pin groove.

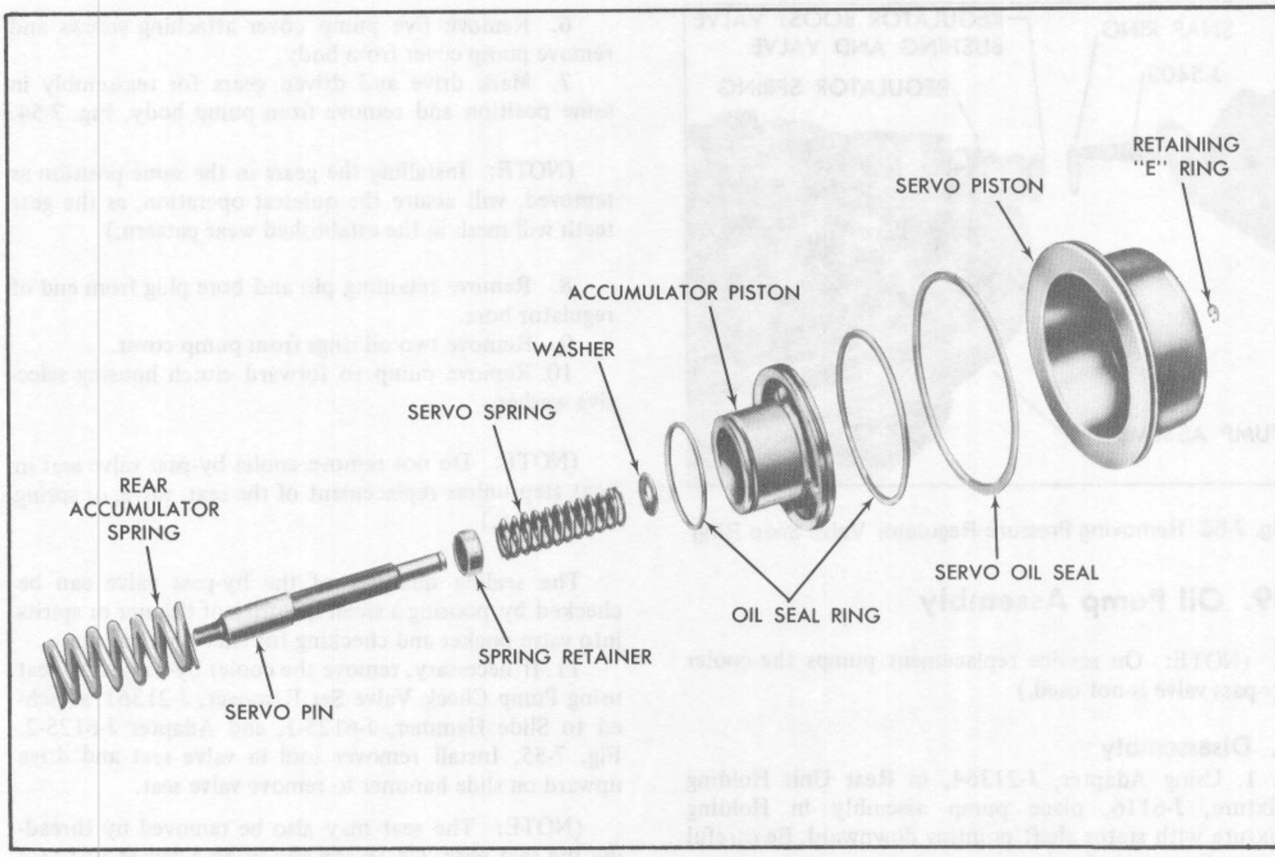


Fig. 7-51 Rear Servo and Accumulator

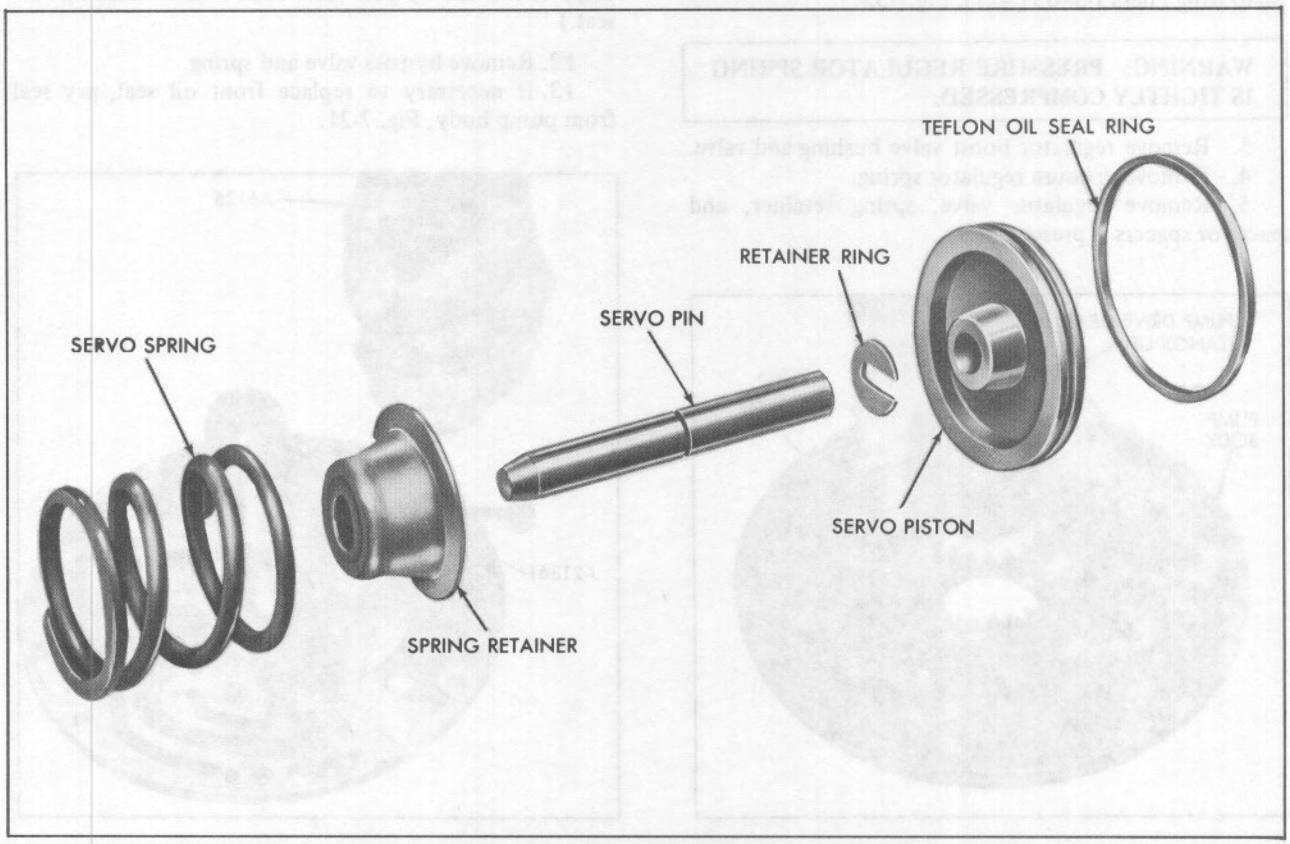


Fig. 7-52 Front Servo

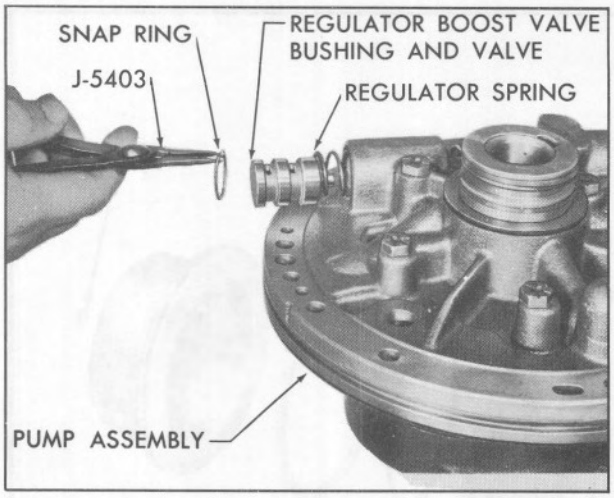


Fig. 7-53 Removing Pressure Regulator Valve Snap Ring

39. Oil Pump Assembly

(NOTE: On service replacement pumps the cooler by-pass valve is not used.)

a. Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place pump assembly in Holding Fixture with stator shaft pointing downward. Be careful not to damage shaft.
2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers J-5403 (#21), Fig.7-53.

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED.

3. Remove regulator boost valve bushing and valve.
4. Remove pressure regulator spring.
5. Remove regulator valve, spring retainer, and spacer or spacers if present.

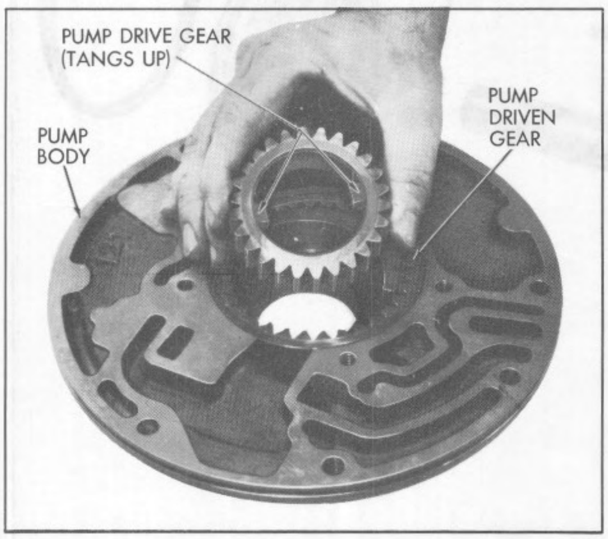


Fig. 7-54 Removing Pump Gears

6. Remove five pump cover attaching screws and remove pump cover from body.
7. Mark drive and driven gears for reassembly in same position and remove from pump body, Fig. 7-54.

(NOTE: Installing the gears in the same position as removed, will assure the quietest operation, as the gear teeth will mesh in the established wear pattern.)

8. Remove retaining pin and bore plug from end of regulator bore.
9. Remove two oil rings from pump cover.
10. Remove pump to forward clutch housing selective washer.

(NOTE: Do not remove cooler by-pass valve seat in next step unless replacement of the seat, valve, or spring is necessary.)

The sealing qualities of the by-pass valve can be checked by pouring a small quantity of thinner or spirits into valve pocket and checking for excessive leakage.

11. If necessary, remove the cooler by-pass valve seat using Pump Check Valve Set Remover, J-21361, attached to Slide Hammer, J-6125-1, and Adapter J-6125-2, Fig. 7-55. Install remover tool in valve seat and drive upward on slide hammer to remove valve seat.

(NOTE: The seat may also be removed by threading the seat with 3/8-16 tap and using Adapter J-6125-2 on Slide Hammer, J-6125-1, to drive seat out. If this method is used, flush all foreign material and machining chips out of the by-pass valve bore before installing new seat.)

12. Remove by-pass valve and spring.
13. If necessary to replace front oil seal, pry seal from pump body, Fig. 7-21.

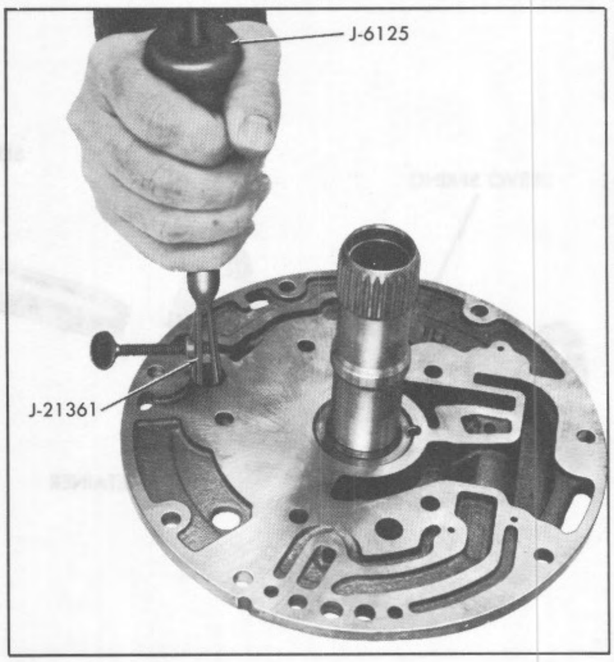


Fig. 7-55 Removing By Pass Valve Seat

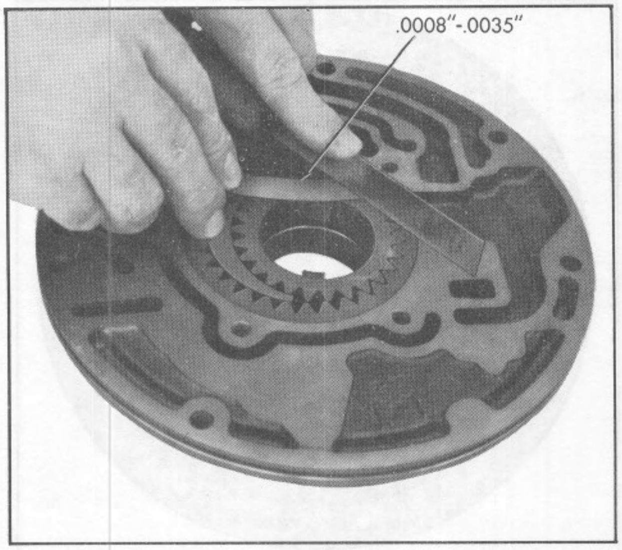


Fig. 7-56 Pump Body Face to Gear Face Clearance

b. Inspection of Pump Body

1. Inspect gear pockets and crescent for scoring, galling or other damage.
2. Place pump gears in pump body and check pump body face to gear face clearance. Clearance should be .0008 inch-.0035 inch, Fig. 7-56.
3. Check face of pump body for scores or nicks.
4. Check oil passages for proper opening and lack of porosity.
5. Check for damaged cover bolt attaching threads.
6. Check for overall flatness of pump body face.
7. Check bushing for scores or nicks.

c. Inspection of Pump Cover (Fig. 7-57)

1. Inspect pump cover face for overall flatness.
2. Check for scores or dirt in pressure regulator bore.
3. Make certain all passages are open and not interconnected through porosity.
4. Check for scoring or damage at pump gear face.
5. Inspect stator shaft for damaged splines, or scored bushings.
6. Inspect oil ring grooves for damage or wear.
7. Inspect cooler by-pass valve to be sure it seats properly.
8. Inspect selective thrust washer face for wear or damage.
9. Install pump cover oil rings into counterbore at forward clutch housing and check for proper fit.

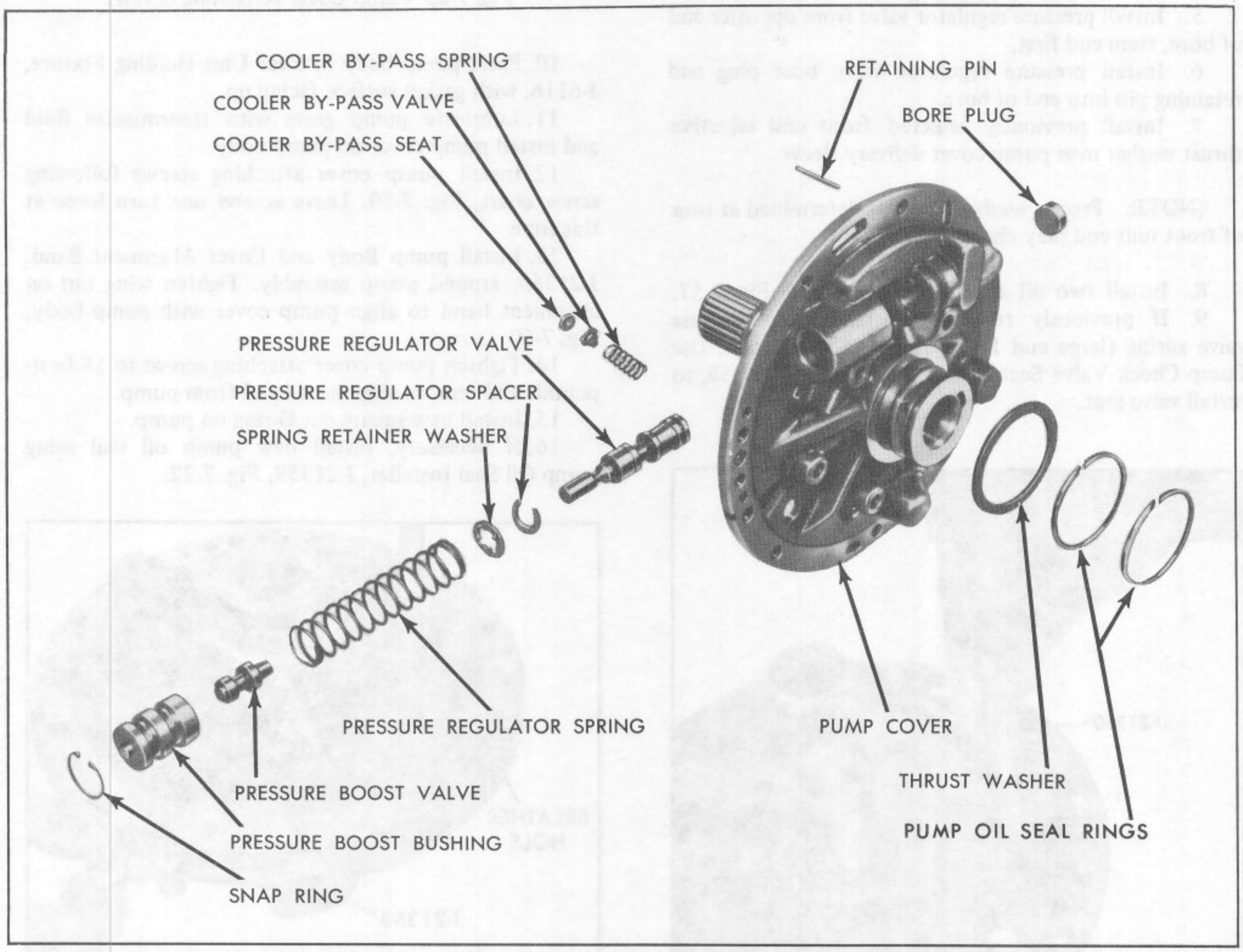


Fig. 7-57 Pump Cover—Exploded View

10. Inspect pressure regulator and boost valve for free operation.

(NOTE: The solid type pressure regulator valve does not contain oil holes and an orifice cup plug like the previous pressure regulator valve. The solid style valve must only be used in the pump cover with the squared off pressure regulator boss, (Pressure boost bushing end). See Fig. 7-19. The previous pressure regulator valve with the oil holes and orifice cup plug will be used to service either type pump cover.)

11. Inspect pump cover for open 1/8 inch diameter breather hole. See Fig. 7-12.

d. Assembly

1. Install drive and driven pump gears into pump body with alignment marks up and mated. In this position the pump gear drive tangs will also be up.
2. Install pressure regulator spacer or spacers, if required, spring retainer and spring into pressure regulator bore.
3. Install boost valve into bushing, stem end out, and install both parts into pump cover by compressing bushing against spring.
4. Install retaining snap ring.
5. Install pressure regulator valve from opposite end of bore, stem end first.
6. Install pressure regulator valve bore plug and retaining pin into end of bore.
7. Install previously selected front unit selective thrust washer over pump cover delivery sleeve.

(NOTE: Proper washer size was determined at time of front unit end play check (Note 23.)

8. Install two oil seal rings, as shown in Fig. 7-57.
9. If previously removed, install cooler by-pass valve spring (large end first), valve, and valve seat. Use Pump Check Valve Seat Installer, J-21360, Fig. 7-58, to install valve seat.

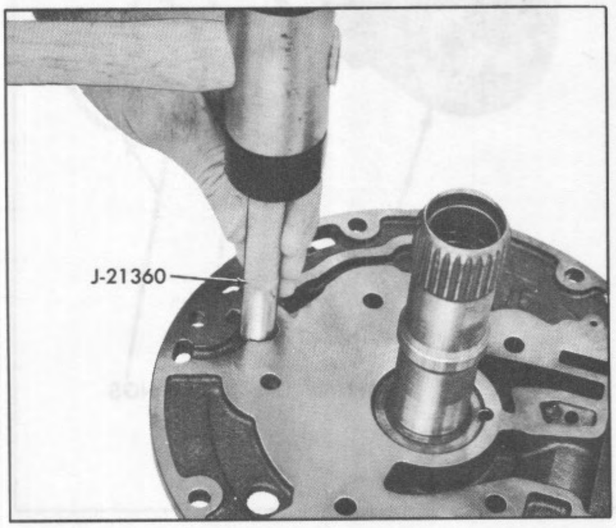
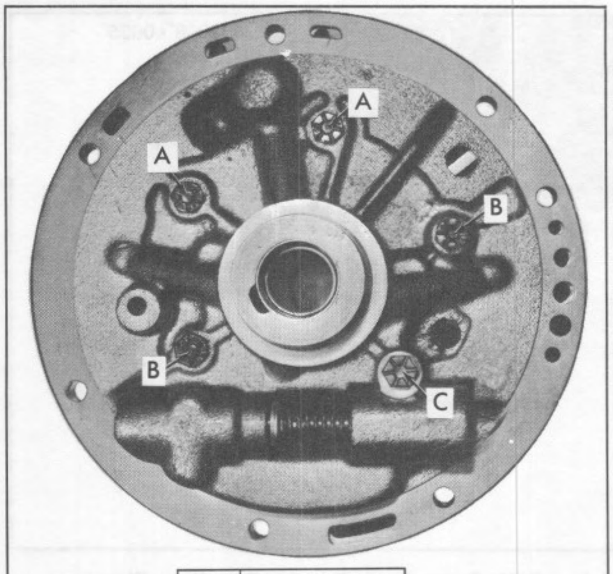


Fig. 7-58 Installing By Pass Valve Seat



BOLT	SIZE
A -	5/16 - 18 x 1
B -	5/16 - 18 x 1½
C -	5/16 - 18 x 1¾

Fig. 7-59 Pump Cover Attaching Screws

10. Place pump body in Rear Unit Holding Fixture, J-6116, with gasket surface facing up.
11. Lubricate pump gears with transmission fluid and install pump cover on pump body.
12. Install pump cover attaching screws following screw chart, Fig. 7-59. Leave screws one turn loose at this time.
13. Install pump Body and Cover Alignment Band, J-21368, around pump assembly. Tighten wing nut on alignment band to align pump cover with pump body, Fig. 7-60.
14. Tighten pump cover attaching screws to 18 foot-pounds and remove alignment band from pump.
15. Install new square cut O-ring on pump.
16. If necessary, install new pump oil seal using pump Oil Seal Installer, J-21359, Fig. 7-22.

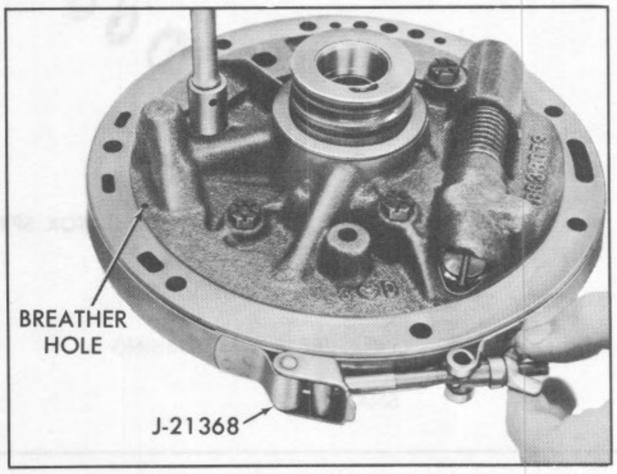


Fig. 7-60 Aligning Pump Cover and Body

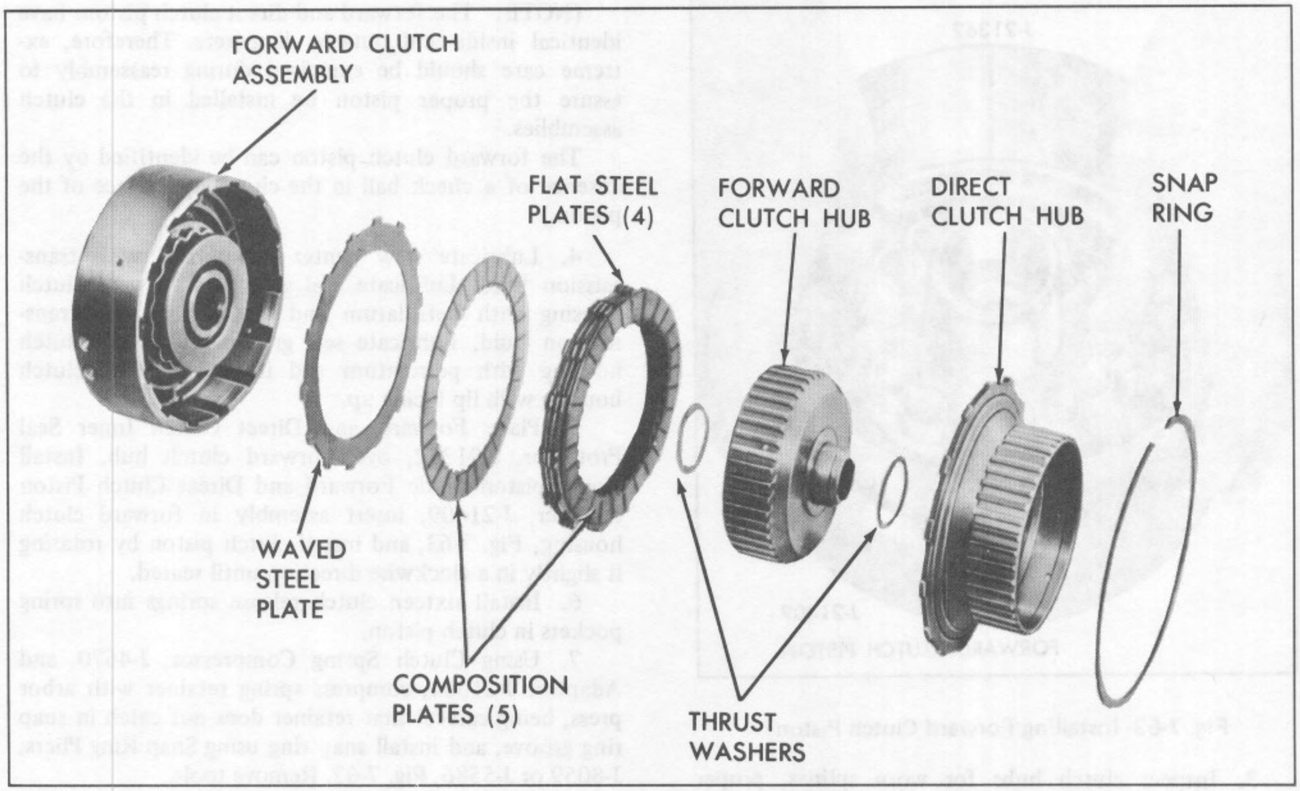


Fig. 7-61 Forward Clutch Assembly—Exploded View

40. Forward Clutch Assembly-Disassembly

a. Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place forward clutch assembly in Holding Fixture with turbine shaft pointing doward. Be careful not to damage shaft.
2. Remove forward clutch housing to direct clutch hub snap ring.
3. Remove direct clutch hub.
4. Remove forward clutch hub and one thrust washer from each side of hub, Fig. 7-61.
5. Remove five composition and five steel clutch plates.
6. Place forward clutch assembly in arbor press with turbine shaft pointing downward.
7. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-62.
8. Remove tools, spring retainer and 16 clutch release springs. Keep springs separate from direct clutch springs.
9. Remove forward clutch piston from forward clutch housing.
10. Remove inner and outer seals from clutch piston.
11. Remove center piston seal from forward clutch housing.
12. It is not necessary to remove turbine shaft from forward clutch housing unless either shaft or housing is damaged and must be replaced. In such case proceed as follows:

   a. Place forward clutch housing in arbor press with turbine shaft pointing downward.

   b. Using 3/8 inch drive extension approximately 3 inches long, or similar tool as driver, press turbine shaft out of forward clutch housing.

b. Inspection

1. Inspect composition faced and steel clutch plates for signs of burning, scoring or wear.
2. Inspect sixteen release springs for collapsed coils or signs of distortion.

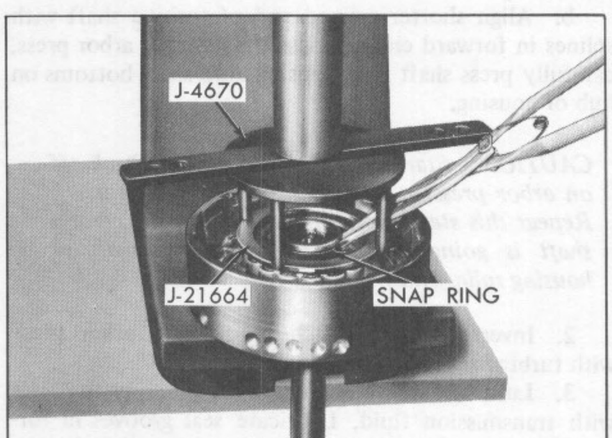


Fig. 7-62 Removing Foreward Clutch Snap Ring

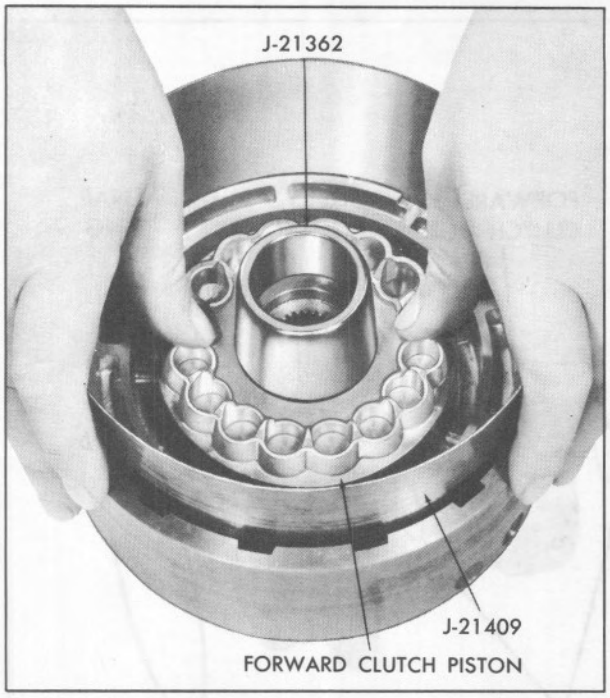


Fig. 7-63 Installing Forward Clutch Piston

3. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.
4. Inspect piston for cracks.
5. Inspect clutch housing for wear, scoring, cracks and open oil passages.
6. Inspect operation of ball check in forward clutch housing.
7. Inspect turbine shaft for open lubrication passages at each end.
8. Inspect turbine shaft splines for damage.
9. Inspect bushing journals for damage.
10. Inspect turbine shaft for cracks or distortion.

c. Assembly

1. If turbine shaft was previously removed from forward clutch housing proceed as follows:

a. Place forward clutch housing on arbor press with flat side up.

b. Align shorter splined end of turbine shaft with splines in forward clutch housing, and using arbor press, carefully press shaft into housing until shaft bottoms on hub of housing.

CAUTION: Start shaft into housing and back off on arbor press to allow shaft to straighten itself. Repeat this step several times until you are certain shaft is going in straight, otherwise, shaft or housing splines may be damaged.

2. Invert forward clutch housing on arbor press with turbine shaft pointing downward.

3. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.

(NOTE: The forward and direct clutch pistons have identical inside and outside diameters. Therefore, extreme care should be exercised during reassembly to assure the proper piston be installed in the clutch assemblies.

The forward clutch piston can be identified by the absence of a check ball in the clutch apply face of the piston.)

4. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and install seal into clutch housing with lip facing up.

5. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-63, and install clutch piston by rotating it slightly in a clockwise direction until seated.

6. Install sixteen clutch release springs into spring pockets in clutch piston.

7. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-62. Remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

8. Remove forward clutch assembly from arbor press and place in Holding Fixture, J-6116, with turbine shaft pointing down. Be careful not to damage shaft.

9. Install thrust washer on the outside of forward clutch hub. The bronze washer is installed on side of hub facing forward clutch housing.

10. Install forward clutch hub in forward clutch housing.

11. Lubricate the four flat steel, five composition and one waved U-notched steel clutch plates with transmission fluid and install clutch plates in forward clutch

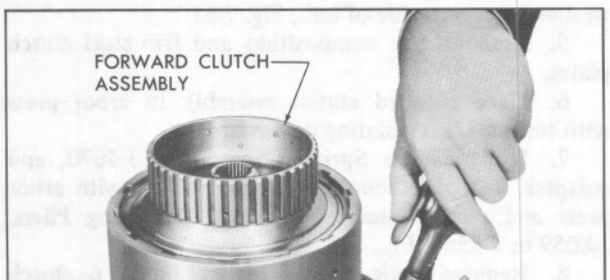


Fig. 7-64 Air Checking Forward Clutch

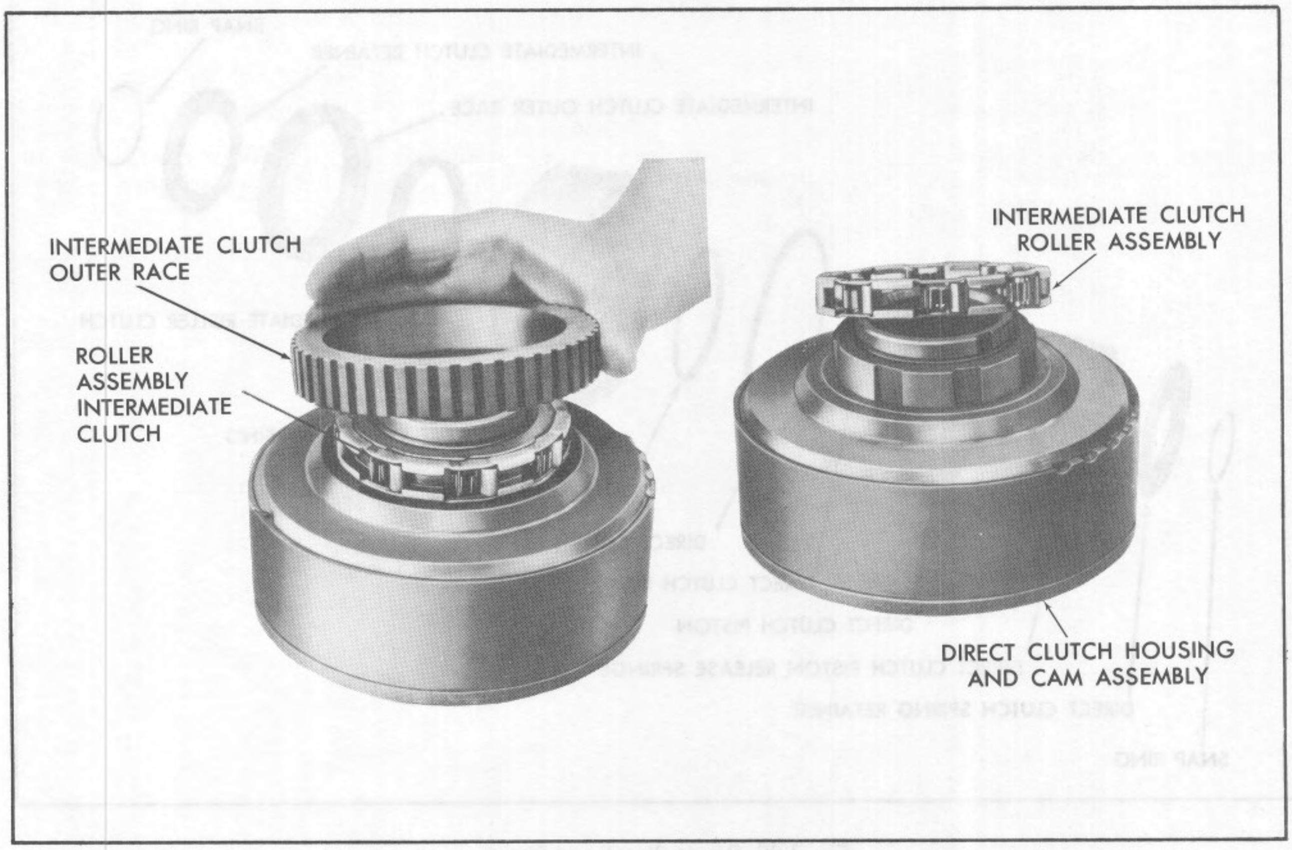


Fig. 7-65 Removing Roller Outer Race and Assembly

housing, Fig. 7-61. Start with waved steel plate and alternate composition and steel plates.

12. Install direct clutch hub in forward clutch housing over clutch plates, and install snap ring.

13. Place forward clutch housing on pump delivery sleeve and air check clutch operation by applying air through forward clutch passage in pump, Fig. 7-64 to actuate piston and move forward clutch.

41. Direct Clutch and Intermediate Roller Assembly (Fig. 7-66)

a. Disassembly

1. Remove roller retainer snap ring, and remove clutch retainer.
2. Remove roller outer race and remove roller assembly. See Fig. 7-65.
3. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.
4. Remove direct clutch backing plate and six composition and six steel clutch plates, Fig. 7-67.
5. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter J-21664. Fig. 7-68, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.
6. Remove tools, spring retainer and 14 clutch release springs. Keep springs separate from forward clurch springs.
7. Remove direct clutch piston from direct clutch housing.
8. Remove inner and outer seals from clutch piston.
9. Remove center piston seal from direct clutch housing.

b. Inspection

1. Inspect roller clutch assembly for damaged rollers, cage or springs.
2. Inspect cam and outer race for scratches or wear.
3. Inspect clutch housing for cracks, wear, proper opening of oil passages and wear on clutch plate drive lugs.
4. Inspect composition-faced and steel clutch plates for signs of wear or burning.
5. Inspect backing plate for scratches or other damage.
6. Inspect piston for cracks and free operation of check ball.
7. Inspect springs for collapsed coils or signs of distortion.

(NOTE: The 14 direct clutch release springs are not serviced individually. If one or more of these springs require replacement, discard all of them and install the 16 service direct clutch release springs.)

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct

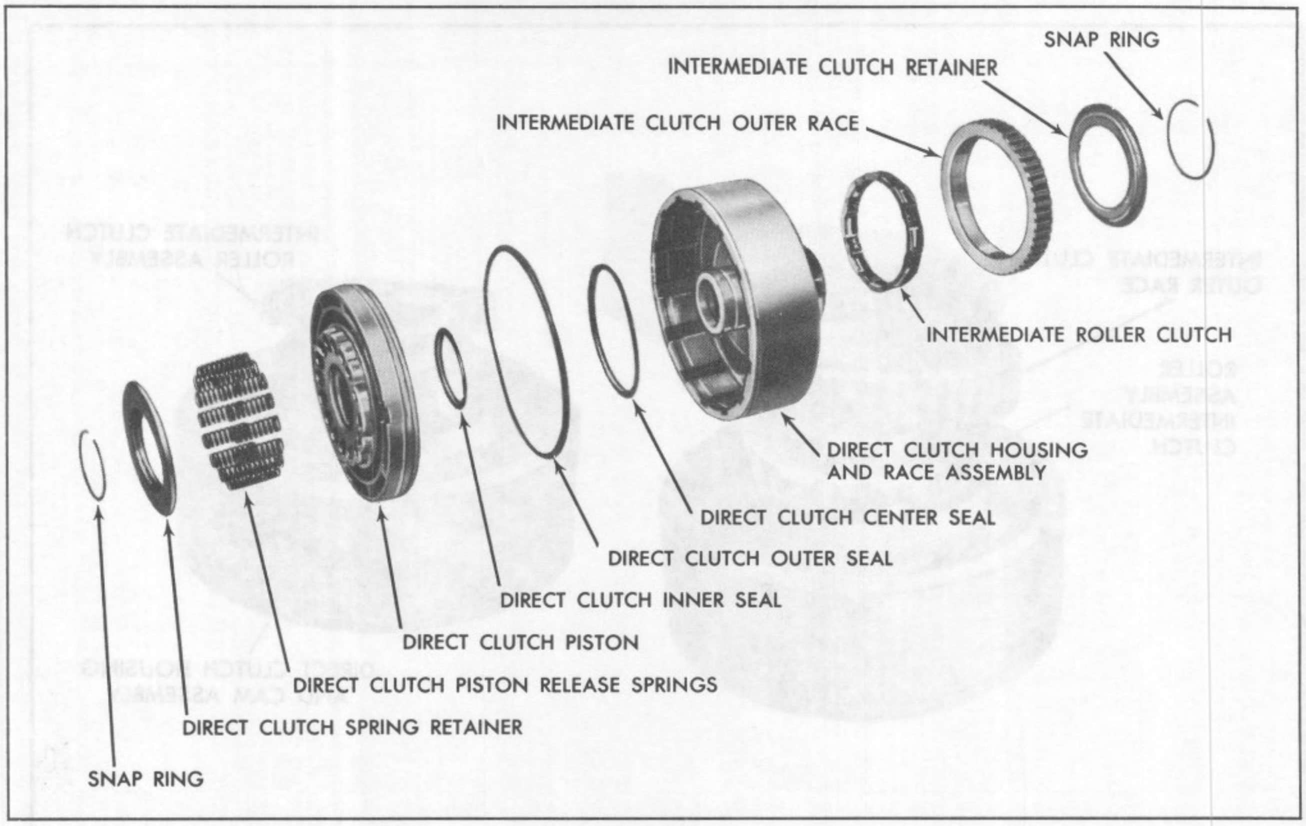


Fig. 7-66 Direct Clutch and Piston

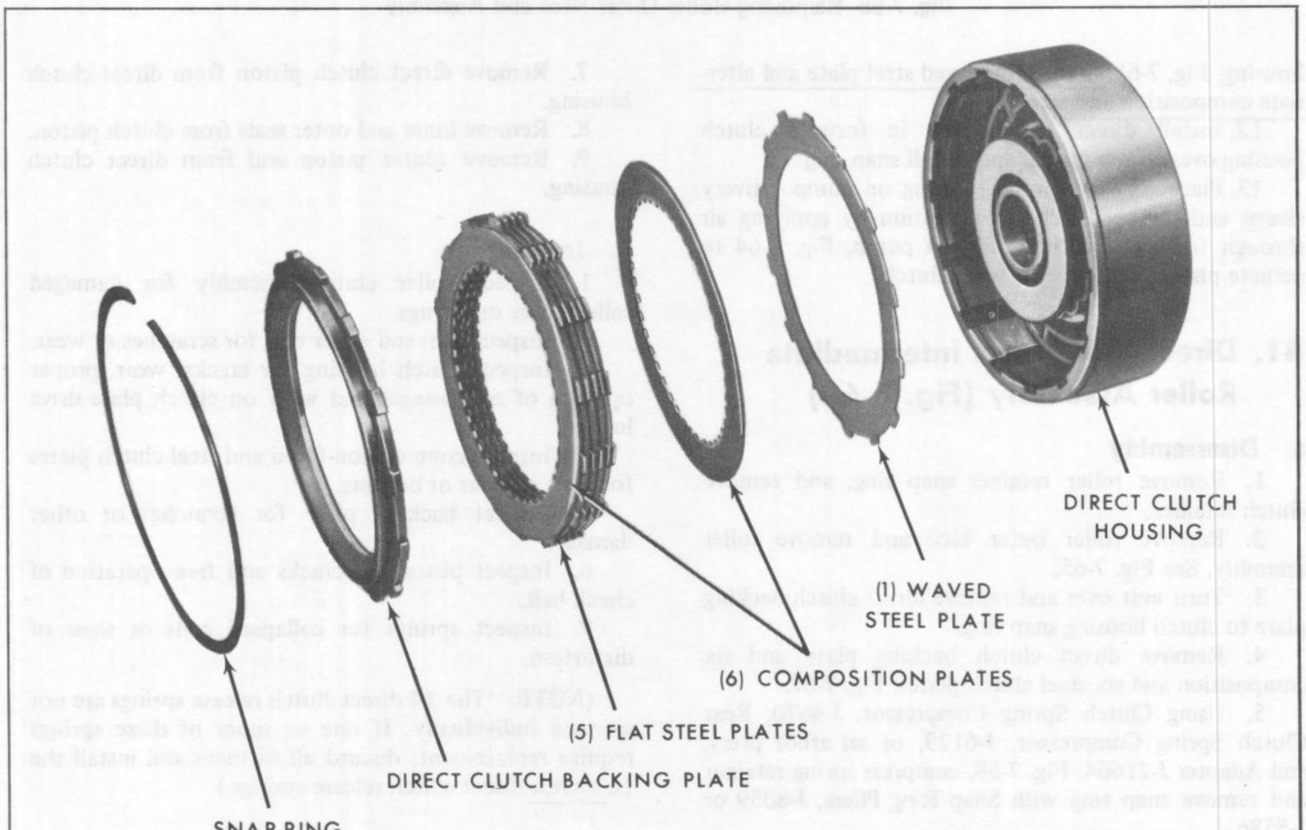


Fig. 7-67 Direct Clutch–Exploded View

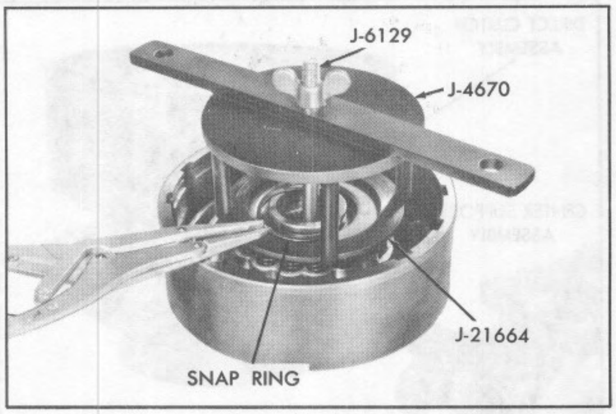


Fig. 7-68 Removing Direct Clutch Snap Ring

clutch piston and install seals with lips facing away from spring pockets.

(NOTE: Make certain piston has check ball.)

2. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.

3. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing, Fig. 7-69, and install clutch piston by rotating it slightly, in a clockwise direction.

4. Install 14 (16 if service) clutch release springs into spring pockets in clutch piston.

5. Place spring retainer and snap ring over springs.

6. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-68, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

(NOTE: Make certain clutch release springs are not leaning. If necessary, straighten spring with a small screwdriver.)

7. Lubricate the five flat and one waved, U-notched steel and six composition clutch plates with transmission fluid and install clutch plates in direct clutch housing

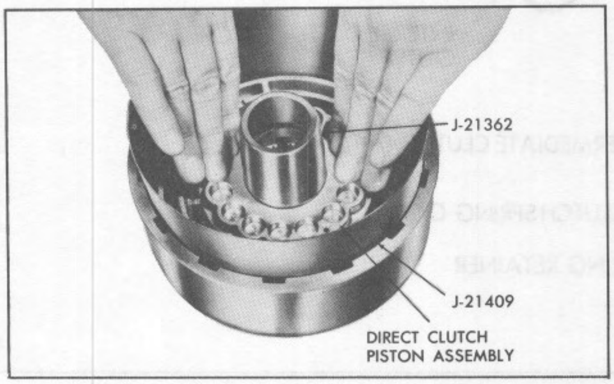


Fig. 7-69 Installing Direct Clutch Piston

Fig. 7-70. Start with waved steel plate and alternate composition and steel plates.

(NOTE: Do not use radially grooved composition plates here.)

8. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

(NOTE: Install rollers that may have come out of the roller cage by compressing the energizing spring with forefinger and inserting the roller from the outer side.

Turn unit over and install the roller clutch assembly onto the intermediate clutch inner cam.

Install the intermediate clutch outer race with a clockwise turning motion.)

(NOTE: When installed, outer race should not turn counterclockwise, Fig. 7-71.)

9. Install roller clutch assembly retainer and snap ring.

10. Place direct clutch assembly on center support and air check operation of direct clutch, Fig. 7-72

(NOTE: If air is applied through reverse passage, (right oil feed hole) it will escape from direct clutch passage (left oil feed hole). This is considered normal. Apply air through left oil feed hole to actuate piston and move direct clutch.)

42. Center Support and Intermediate Clutch Piston

a. Disassembly (Fig. 7-73)

1. Remove four teflon oil rings from the center support, Fig. 7-74.

2. Compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586, Fig. 7-75.

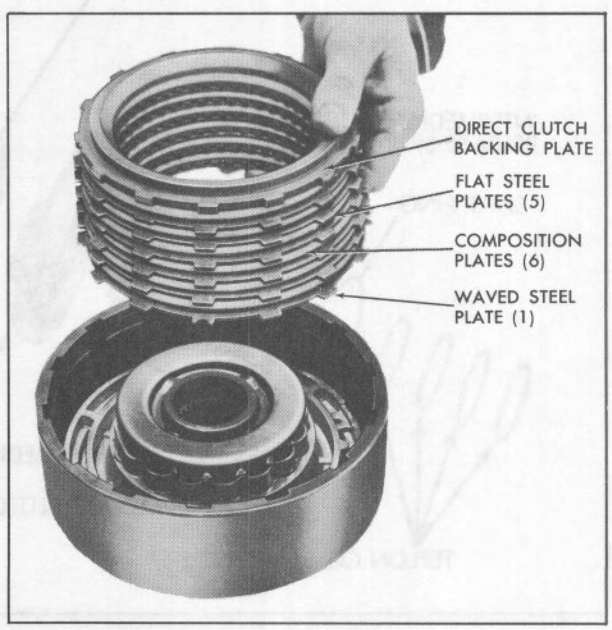


Fig. 7-70 Installing Direct Clutch Plates

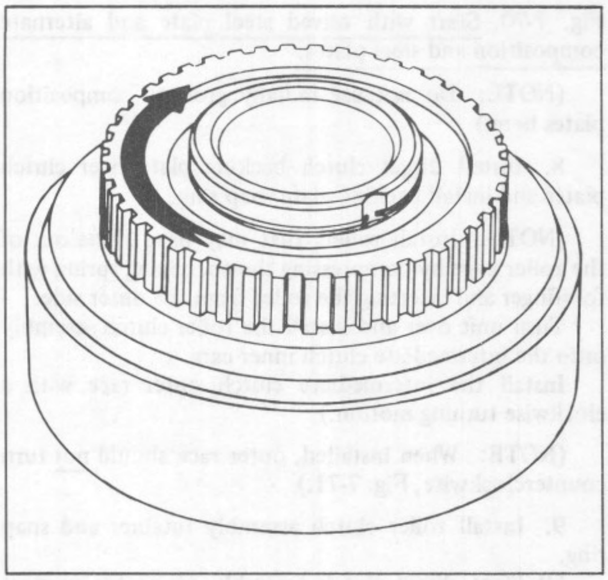


Fig. 7-71 Roller Clutch Rotation

3. Remove spring retainer and 3 intermediate clutch release springs.
4. Remove spring guide.
5. Remove intermediate clutch piston from center support.
6. Remove inner and outer seals from clutch piston.

(NOTE: Do not remove the three screws retaining roller clutch inner race to center support.)

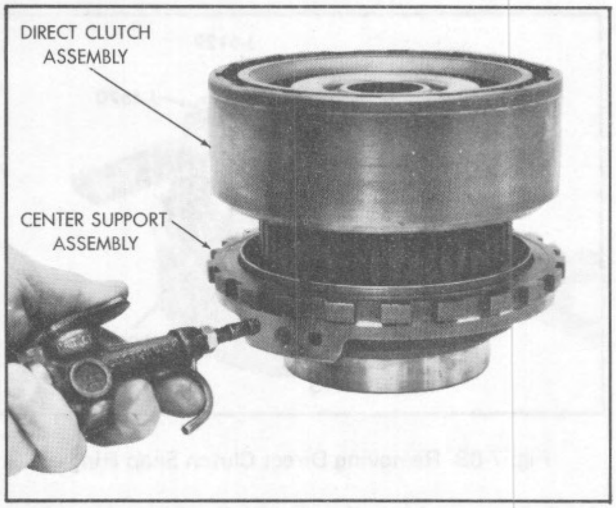


Fig. 7-72 Air Checking Direct Clutch

b. Inspection

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.
2. Inspect bushing for scoring, wear or galling.
3. Check oil ring grooves for damage.
4. Air check oil passages to be sure they are open and not interconnected.
5. Inspect piston sealing surfaces for scratches.
6. Inspect piston seal grooves for nicks or other damages.
7. Inspect piston for cracks.

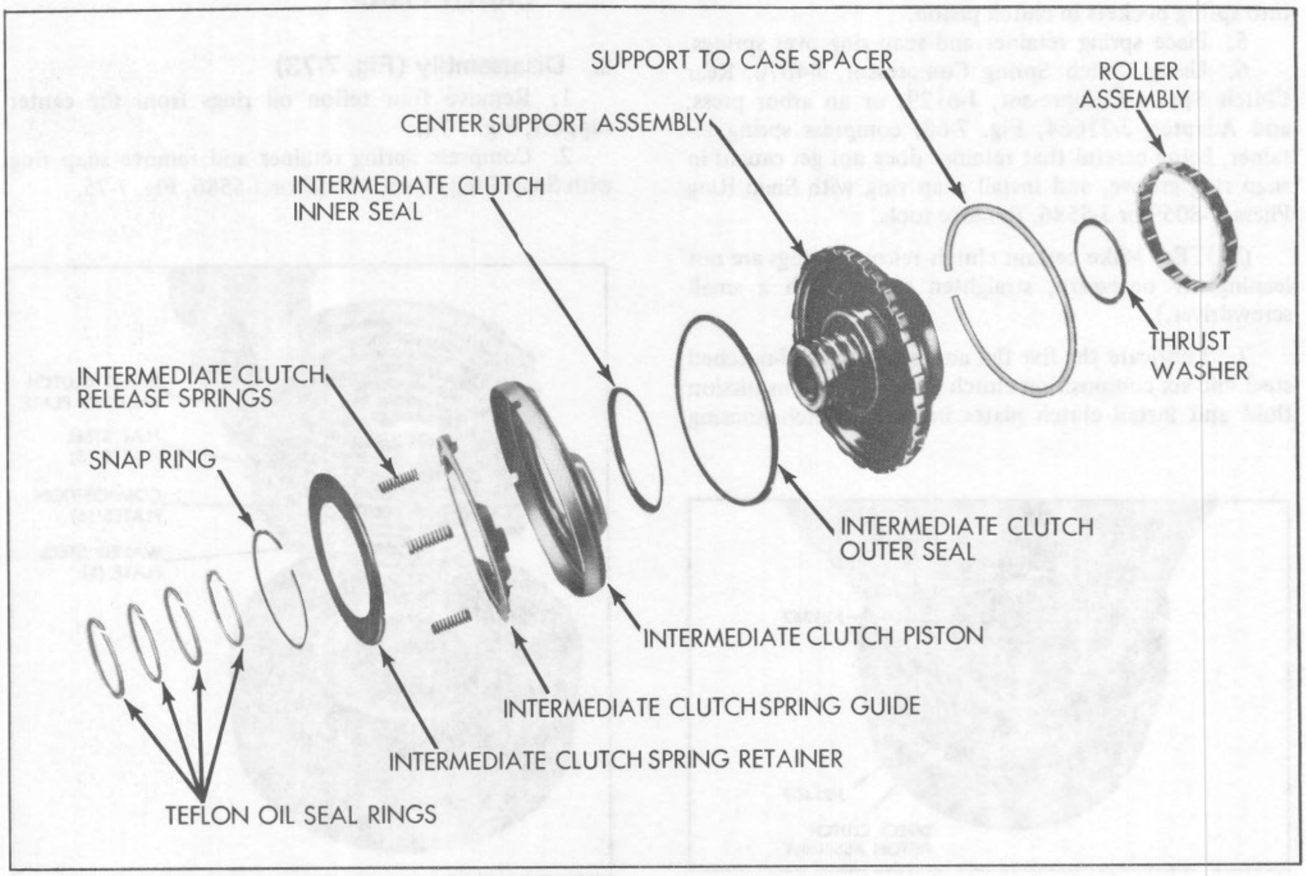


Fig. 7-73 Center Support Assembly–Exploded View

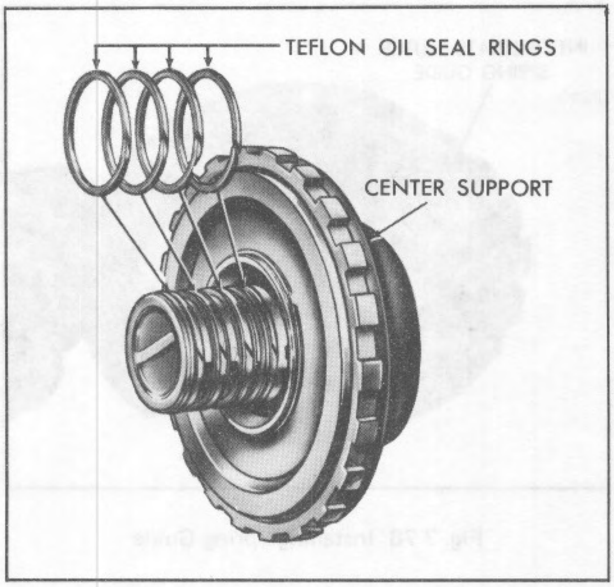


Fig. 7-74 Center Support Oil Seal Rings

8. Inspect springs for collapsed coils or signs of distortion.
9. Inspect oil seal rings for damage.

(NOTE: All service center support oil seal rings are hook type cast iron.)

10. Inspect to see that constant bleed orifice (approx. .020) is open (Fig. 7-41).

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring guide, Fig. 7-76.
2. Place Intermediate Clutch Inner Seal Protector, J-21363, over center support hub, Fig. 7-77, and install intermediate clutch piston, making certain it fully seats in center support. Remove J-21363.
3. Install plastic spring guide, Fig. 7-78.
4. Install 3 clutch release springs, space equally, into holes in spring guide, Fig. 7-79.
5. Place spring retainer and snap ring over springs.
6. Compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586, Fig. 7-75.
7. Install four teflon oil seal rings on the center support, Fig. 7-74.
8. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch pistons, Fig. 7-80.

43. Gear Unit (Fig. 7-81)

a. Disassembly of Gear Unit

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place gear unit in Holding Fixture with output shaft pointing downward.
2. Remove center support to sun gear races and thrust bearing.

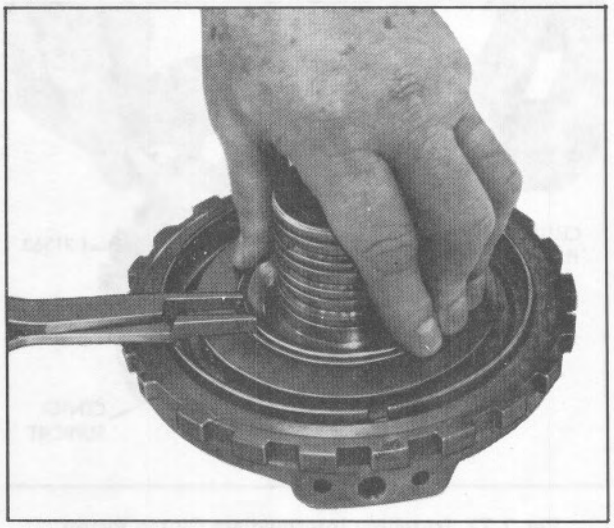


Fig. 7-75 Removing Intermediate Clutch Snap Ring

(NOTE: Outer race may have stuck to center support when it was removed.)

3. Remove sun gear from output carrier assembly.
4. Remove reaction carrier to output carrier thrust washer and front internal gear ring.
5. Invert gear unit in Holding Fixture with main shaft pointing downward.
6. Remove snap ring securing output shaft to output carrier and remove output shaft. Remove O-ring from output shaft and discard.
7. Remove thrust bearing and races from rear internal gear.

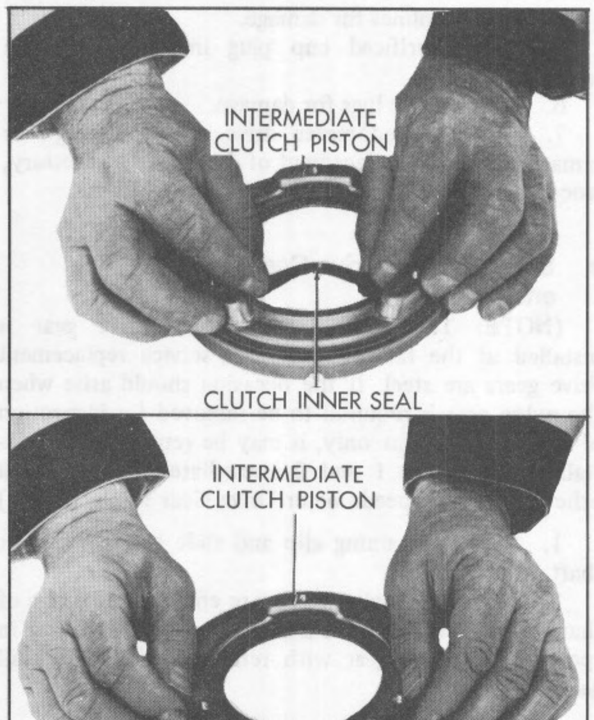


Fig. 7-76 Installing Intermediate Clutch Piston Seals

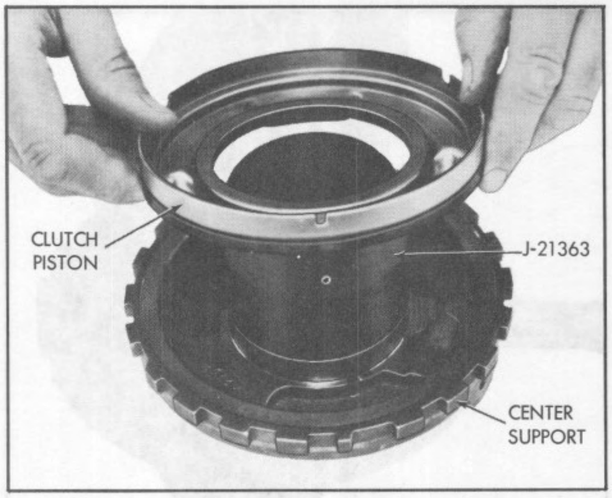


Fig. 7-77 Installing Intermediate Clutch Piston

8. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.

9. Remove snap ring from end of main shaft and remove rear internal gear.

10. Remove output carrier from Holding Fixture.

b. Inspection of Output Shaft

1. Inspect bushing for wear or galling.
2. Inspect bearing and thrust washer surfaces for damage.
3. Inspect governor drive gear for rough or damaged teeth.
4. Inspect splines for damage.
5. Inspect orificed cup plug in the lubrication passage.
6. Inspect drive lugs for damage.
7. Inspect speedometer drive gear for rough or damaged teeth. If replacement of drive gear is necessary, proceed as follows:

c. Speedometer Drive Gear Removal and Installation

(NOTE: The nylon speedometer drive gear is installed at the factory only. All service replacement drive gears are steel. If the occasion should arise when the nylon gear is required to be removed for inspection of the shaft or gear only, it may be removed and reinstalled using steps 1 and 2 immediately below. In all other cases, see Speedometer Drive Gear Replacement.)

1. Depress retaining clip and slide gear off output shaft, Fig. 7-82.

2. Place retaining clip (square end toward flange of shaft) into hole in output shaft, Fig. 7-82. Align slot in speedometer drive gear with retaining clip and install gear.

d. Speedometer Drive Gear Replacement

1. If nylon gear is on shaft, depress retaining clip and slide gear off output shaft, Fig. 7-82. Discard retaining clip.

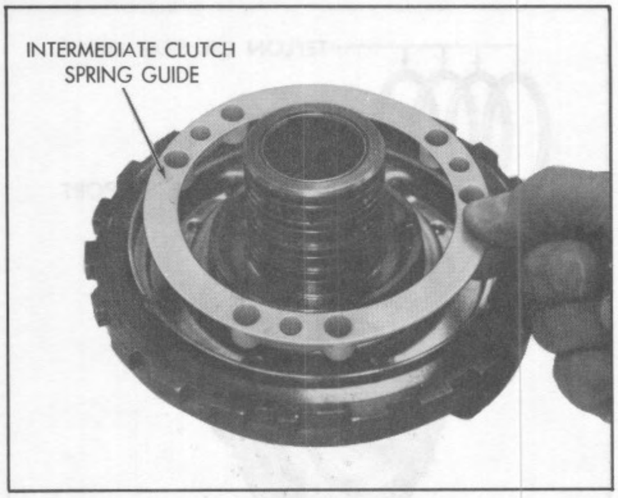


Fig. 7-78 Installing Spring Guide

2. If steel gear is on shaft:

a. Install Speedometer Drive Gear Remover, J-21427, with Pulley Puller, J-8433, and attach, using Speedometer Drive Gear Remover Bolts, J-21797, on output shaft so that puller bolt indexes with end of shaft and flat face of remover tool is under front face of drive gear.

b. Tighten bolt on Pulley Puller, Fig. 7-83, until gear is free on shaft. Remove tools and gear from shaft.

3. Support output shaft and install new steel speedometer drive gear using a piece of pipe.

CAUTION: Use a pipe that closely fits output shaft and does not contact gear teeth. Contact with gear teeth would result in damage to the gear as it is driven into place.

4. Drive gear onto shaft until distance from rear face of gear to end of output shaft is 15 inches, Fig. 7-84.

e. Inspection of Main Shaft

1. Inspect shaft for cracks or distortion.

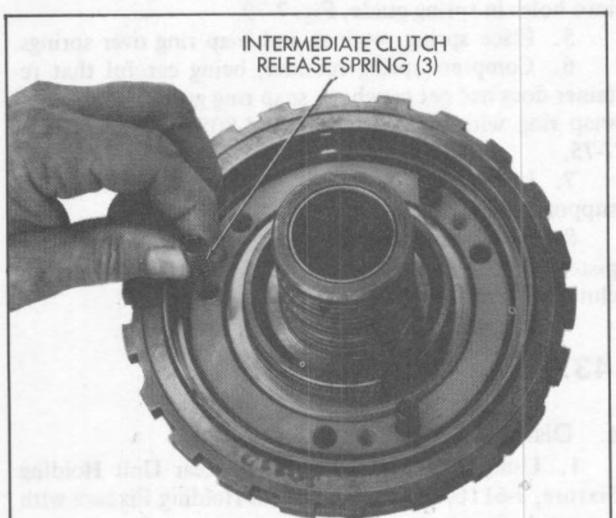


Fig. 7-79 Installing Clutch Release Springs

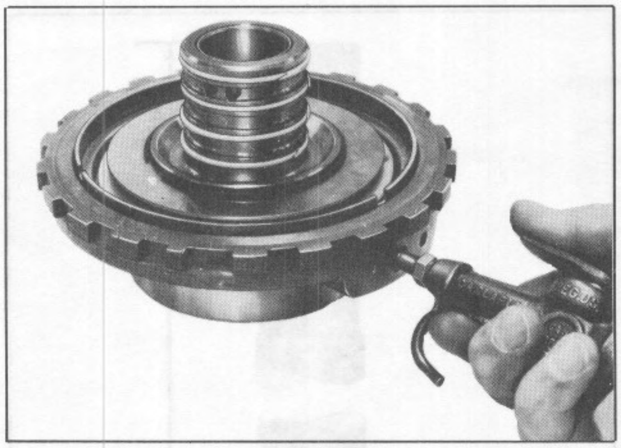


Fig. 7-80 Air Checking Intermediate Clutch

2. Inspect splines for damage.
3. Inspect ground bushing journals for damage.
4. Inspect snap ring groove for damage.
5. Make sure lubrication holes are open.

f. Inspection of Rear Internal Gear

1. Inspect gear teeth and bearing surfaces for damage or wear.

2. Inspect splines for damage.
3. Inspect gear for cracks.

g. Inspection of Output Carrier Assembly

1. Inspect front internal gear for damaged teeth.
2. Inspect pinion gears for damage, rough bearings or tilt.
3. Check pinion end play. Pinion end play should be .009 inch-.024 inch, Fig. 7-85.
4. Inspect parking gear lugs for cracks or damage.
5. Inspect output shaft locating splines for damage.
6. Inspect front internal gear ring for flaking or cracks.

h. Inspection of Reaction Carrier Assembly

1. Inspect band surface on reaction carrier for signs of burning or scoring.
2. Inspect roller clutch outer cam for scoring or wear.
3. Inspect thrust washer surfaces for signs of scoring or wear.
4. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.
5. Inspect pinion gears for damage, rough bearings or excessive tilt.

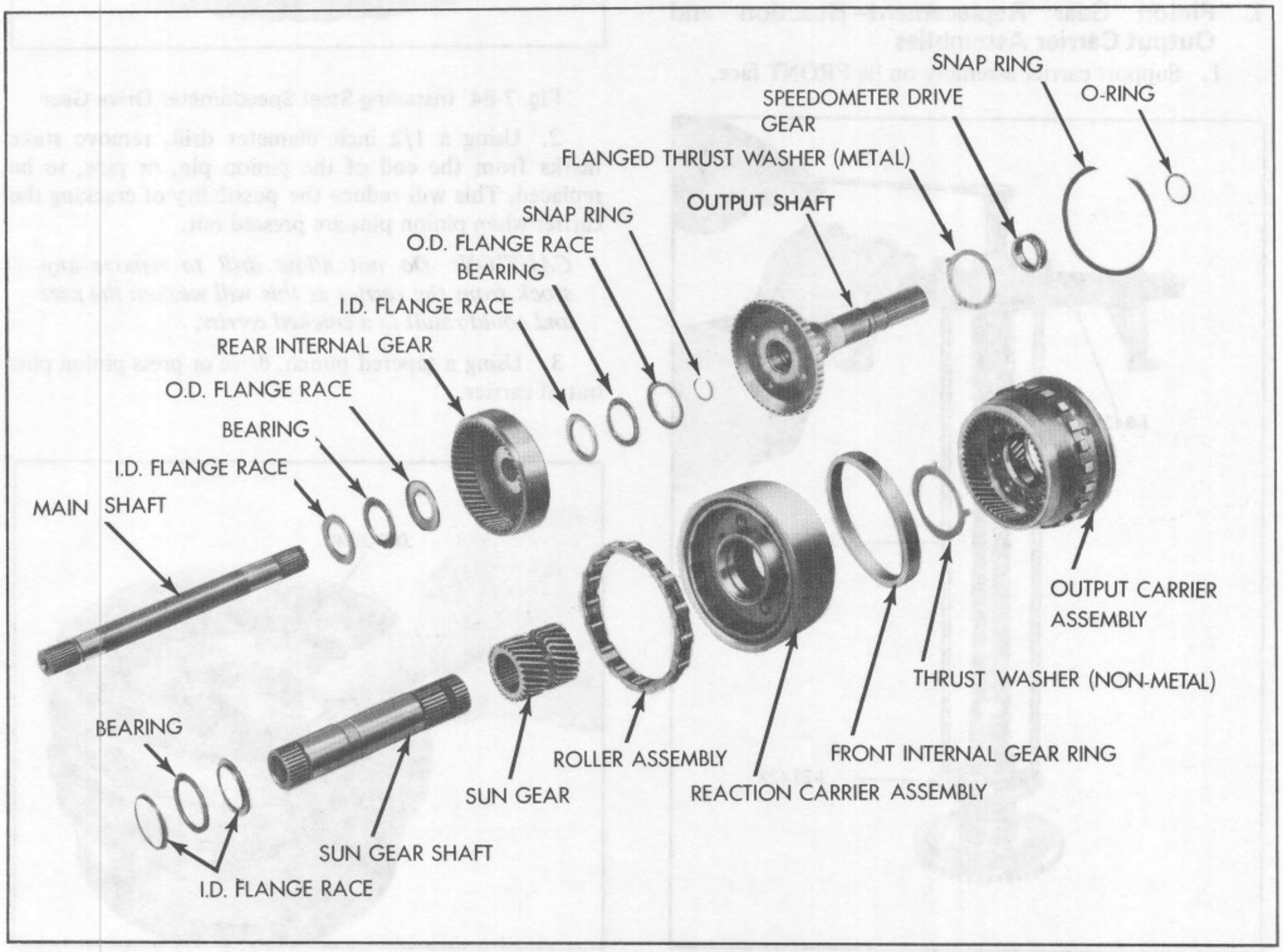


Fig. 7-81 Gear Unit—Exploded View

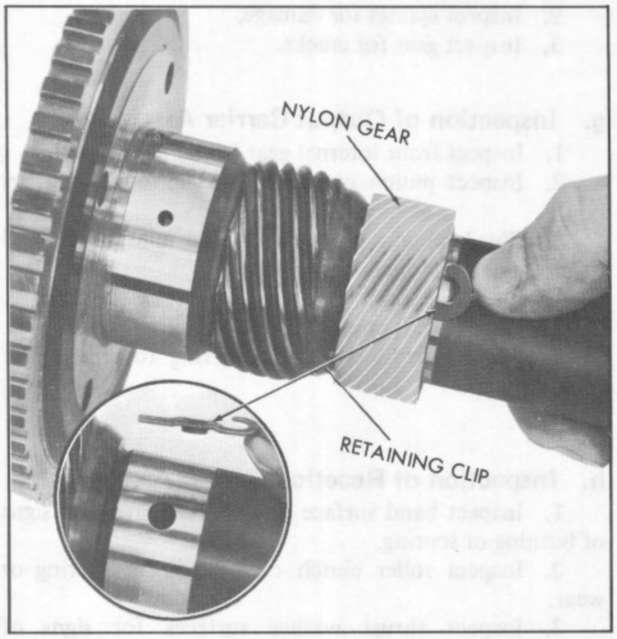


Fig. 7-82 Removing Nylon Speedometer Drive Gear

6. Check pinion end play. Pinion end play should be .009 inch-.024 inch.

i. Pinion Gear Replacement—Reaction and Output Carrier Assemblies

1. Support carrier assembly on its FRONT face.

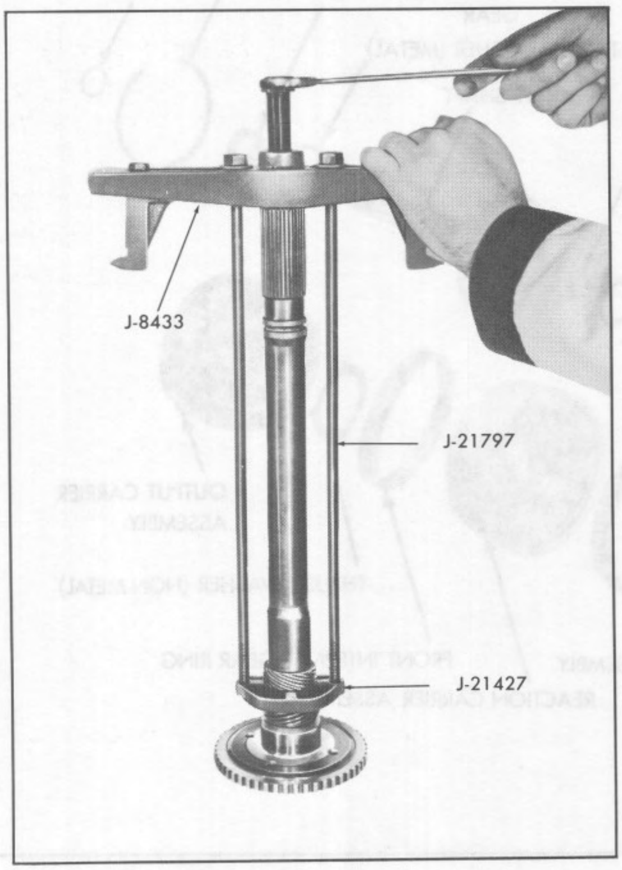


Fig. 7-83 Removing Steel Speedometer Drive Gear

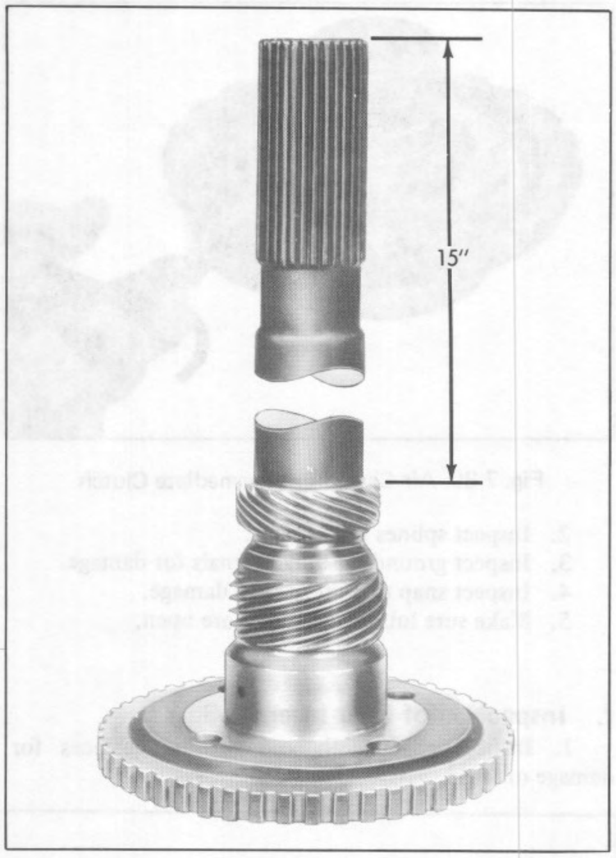


Fig. 7-84 Installing Steel Speedometer Drive Gear

2. Using a 1/2 inch diameter drill, remove stake marks from the end of the pinion pin, or pins, to be replaced. This will reduce the possibility of cracking the carrier when pinion pins are pressed out.

CAUTION: Do not allow drill to remove any stock from the carrier as this will weaken the part and could result in a cracked carrier.

3. Using a tapered punch, drive or press pinion pins out of carrier.

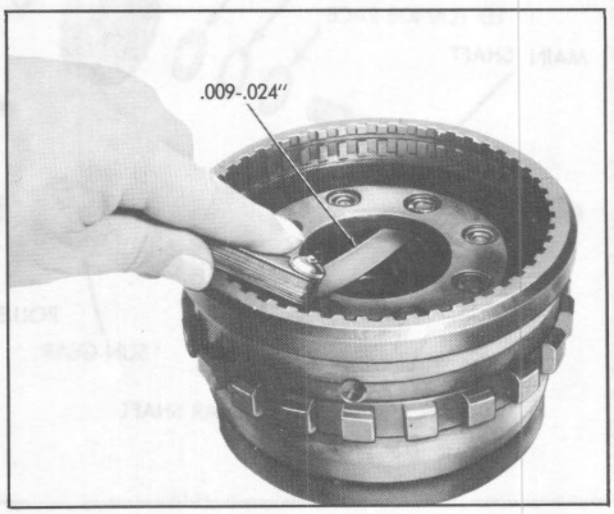


Fig. 7-85 Checking Output Carrier Pinion End Play

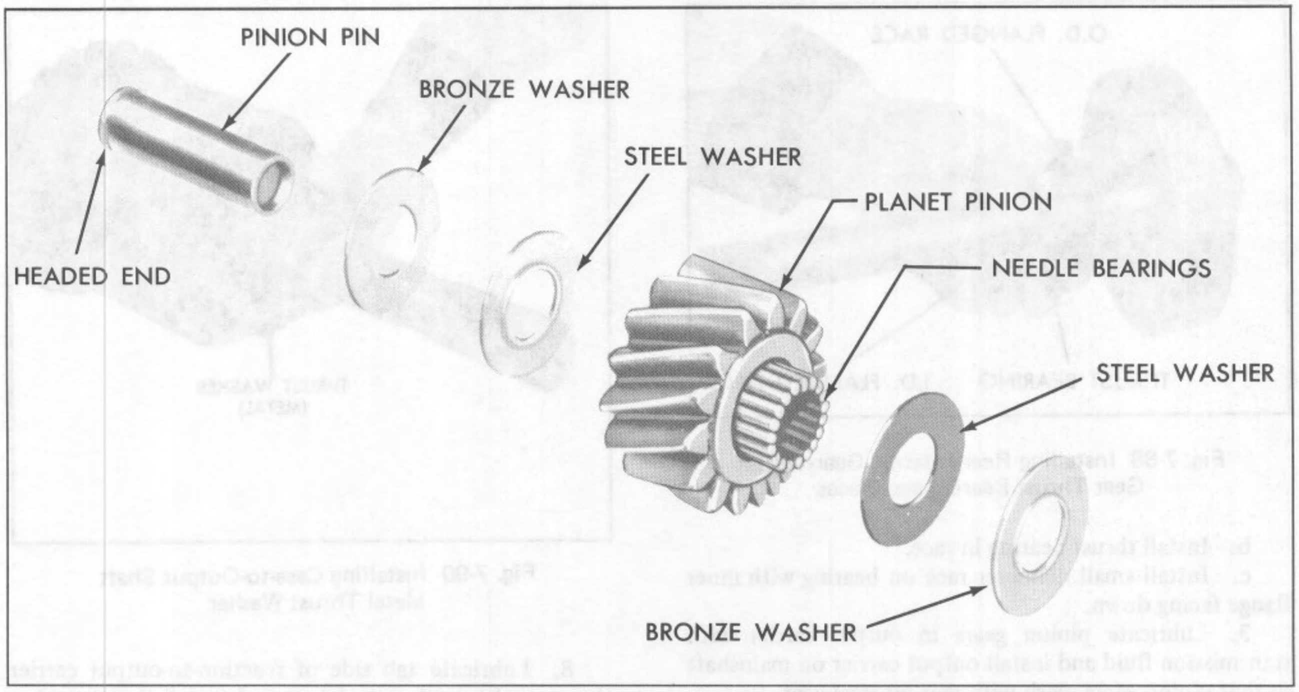


Fig. 7-86 Planet Pinion—Exploded View

4. Remove pinion gears, thrust washers, and roller needle bearings.

5. Inspect pinion pocket thrust faces for burrs and remove if present.

6. Install eighteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.

7. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-86. Hold washers in place with petrolatum.

8. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.

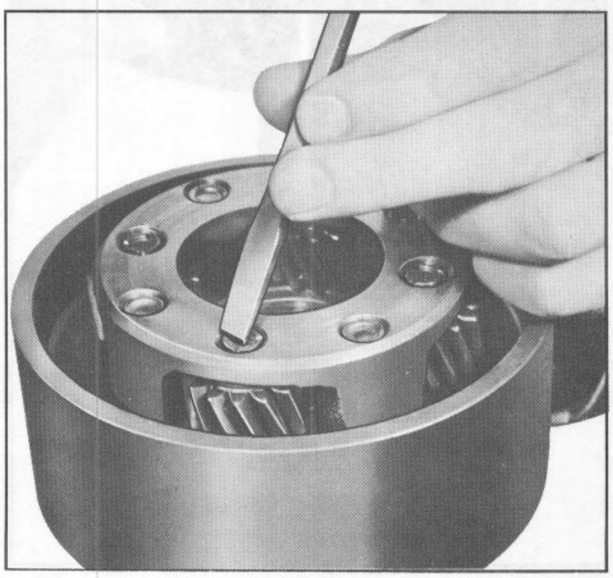


Fig. 7-87 Staking Pinion Pin

9. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.

10. Using a punch and bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-87.

CAUTION: Both ends of pinion pins must lie below face of carrier or interference may occur.

11. Repeat installation procedure for each pinion

j. Inspection of Roller Clutch Assembly

1. Inspect roller clutch for damaged rollers or springs.
2. Inspect roller clutch cage for damage.

k. Inspection of Sun Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Be sure oil lubrication hole is open.

l. Inspection of Sun Gear Shaft

1. Inspect shaft for cracks or splits.
2. Inspect splines for damage.
3. Inspect bushings for scoring or galling.
4. Inspect ground bushing journals for damage.
5. Be sure oil lubrication hole is open.

m. Assembly of Complete Gear Unit

1. Install rear internal gear on end of mainshaft that has snap ring groove and install snap ring.

2. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

a. Install large diameter race first, with flange facing up, Fig. 7-88.

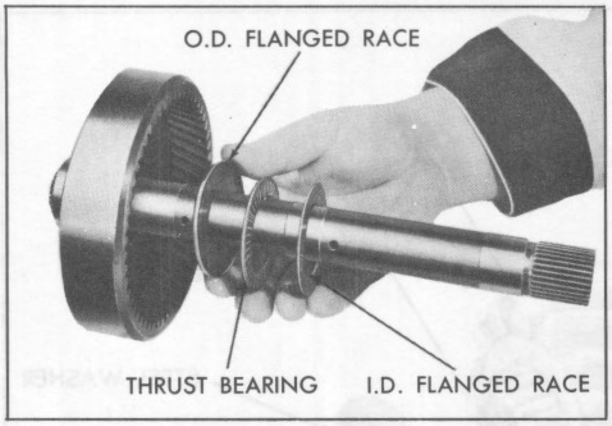


Fig. 7-88 Installing Rear Internal Gear-to-Sun Gear Thrust Bearing and Races

b. Install thrust bearing in race.

c. Install small diameter race on bearing with inner flange facing down.

3. Lubricate pinion gears in output carrier with transmission fluid and install output carrier on mainshaft so that pinion gears mesh with rear internal gear.

4. Place assembly in Rear Unit Holding Fixture, J-6116, with mainshaft pointing downward. Be careful not to damage shaft.

5. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

a. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-89.

b. Install thrust bearing in race.

c. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.

6. Install output shaft into output carrier and install snap ring. Install new O-ring on output shaft.

7. Invert assembly in Holding Fixture with output shaft pointing downward.

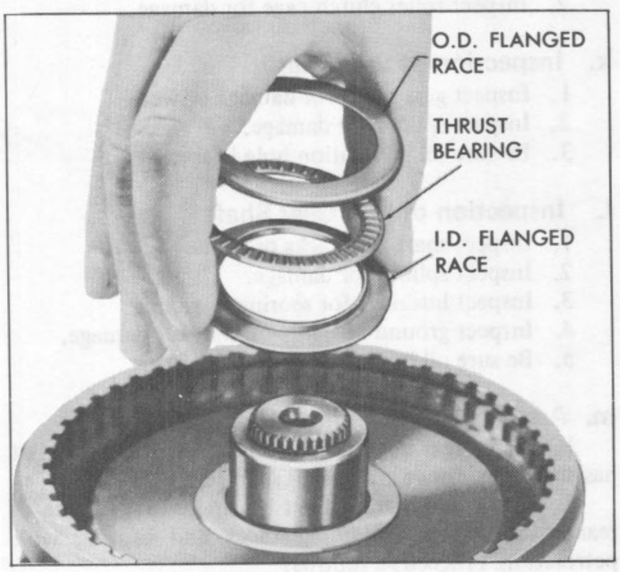


Fig. 7-89 Internal Gear, Thrust Bearing and Races

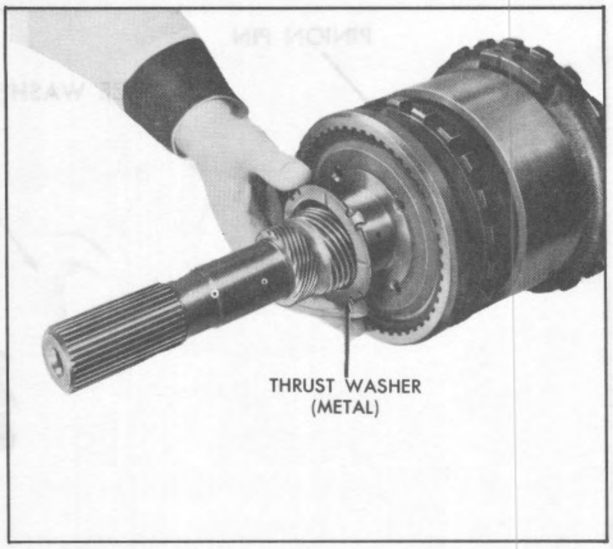


Fig. 7-90 Installing Case-to-Output Shaft Metal Thrust Washer

8. Lubricate tab side of reaction-to-output carrier thrust washer with petrolatum and install thrust washer in output carrier with tabs in tab pockets.

9. Install sun gear with end having chamfered I.D. facing down.

Fig. 7-91 Installing Reaction Carrier to Output Carrier

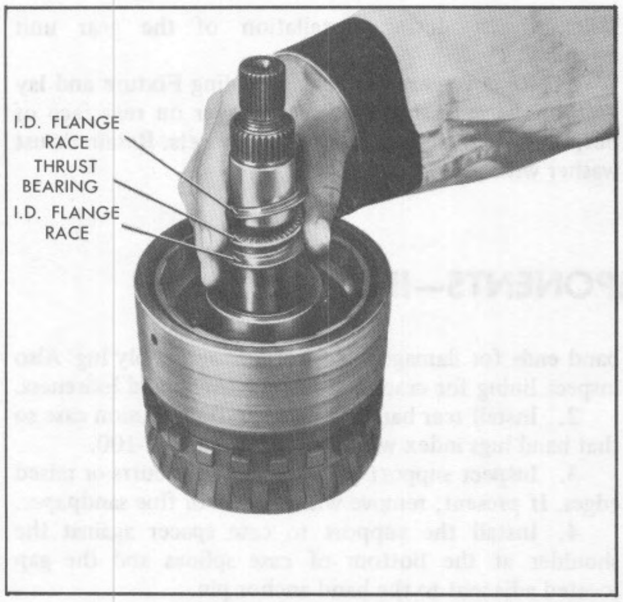


Fig. 7-92 Installing Center Support Thrust Bearing Over Sun Gear Shaft

10. Install sun gear shaft with longer splined end down.

11. Install gear ring over output carrier.

12. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier, Fig. 7-91, so that pinion gears mesh with front internal gear.

(NOTE: When a new output carrier and/or reaction carrier is being installed, and if the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring. The front internal gear ring is a selective fit at the factory but not in service.)

13. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

14. Install thrust bearing on race.

15. Lubricate small diameter race with petrolatum and install race on center support with flange facing toward lower end, Fig. 7-92.

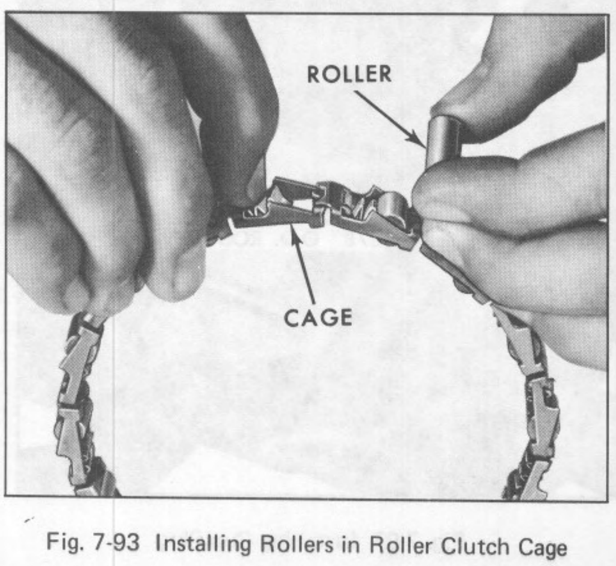


Fig. 7-93 Installing Rollers in Roller Clutch Cage

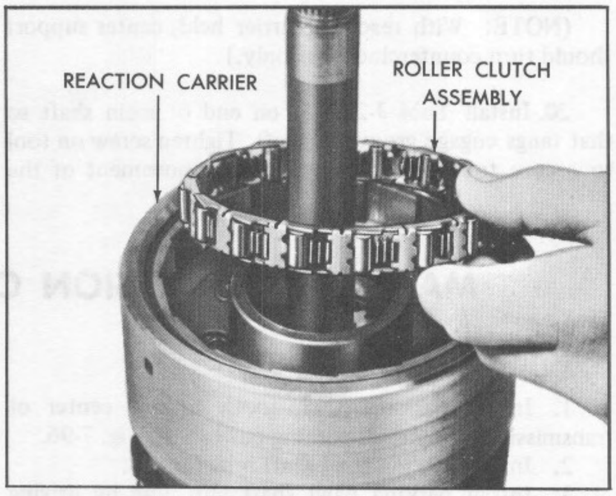


Fig. 7-94 Installing Roller in Reaction Carrier

16. Lubricate reaction carrier to center support thrust washer with petrolatum and install washer in recess in center support.

17. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with forefinger and inserting roller from outer side, Fig. 7-93.

(NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.)

18. Install roller clutch assembly in reaction carrier, Fig. 7-94.

19. Install center support assembly into roller clutch in reaction carrier, Fig. 7-95.

(NOTE: Be sure that center support to reaction carrier thrust washer is in place before installing center support assembly into roller clutch in reaction carrier.)

Fig. 7-95 Installing Center Support to Reaction Carrier

(NOTE: With reaction carrier held, center support should turn counterclockwise only.)

20. Install Tool J-21365, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly.

21. Remove gear unit from Holding Fixture and lay unit on its side. Install thrust washer on rear face of output shaft with bent tabs in tab pockets. Retain thrust washer with petrolatum.

MAJOR TRANSMISSION COMPONENTS—INSTALLATION

44. Install Parking Pawl

1. Install parking pawl, tooth toward center of transmission, and install parking pawl shaft, Fig. 7-96.
2. Install parking pawl shaft retainer clip.
3. Install parking pawl shaft cup plug by driving into the transmission case, using a 3/8 inch diameter rod, until the parking pawl shaft bottoms on the case rib, Fig. 7-97.
4. Install parking pawl return spring with square end hooked on pawl.
5. Install parking pawl bracket with guides over parking pawl, Fig. 7-98. Install two attaching screws and tighten screws to 18 foot-pounds.

45. Install Support to Case Spacer Rear Band and Complete Gear Unit Assembly

1. Inspect rear band for cracks or distortion and band ends for damage at anchor lugs and apply lug. Also inspect lining for cracks, flaking, burning and looseness.
2. Install rear band assembly in transmission case so that band lugs index with anchor pins, Fig. 7-100.
3. Inspect support to case spacer for burrs or raised edges. If present, remove with a stone or fine sandpaper.
4. Install the support to case spacer against the shoulder at the bottom of case splines and the gap located adjacent to the band anchor pin.

CAUTION: Do not confuse this spacer (.040" *thick and both sides flat) with either the center support to case snap ring (one side beveled) or the backing plate to case snap ring (.093" thick and both sides flat).*

5. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

(NOTE: Proper washer size was determined at time of rear unit end play check Note 27.)

6. Place transmission case in Holding Fixture in horizontal position. Do not over-tighten transmission Holding Fixture side pivot pin as this will cause binding when gear unit is installed.
7. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline

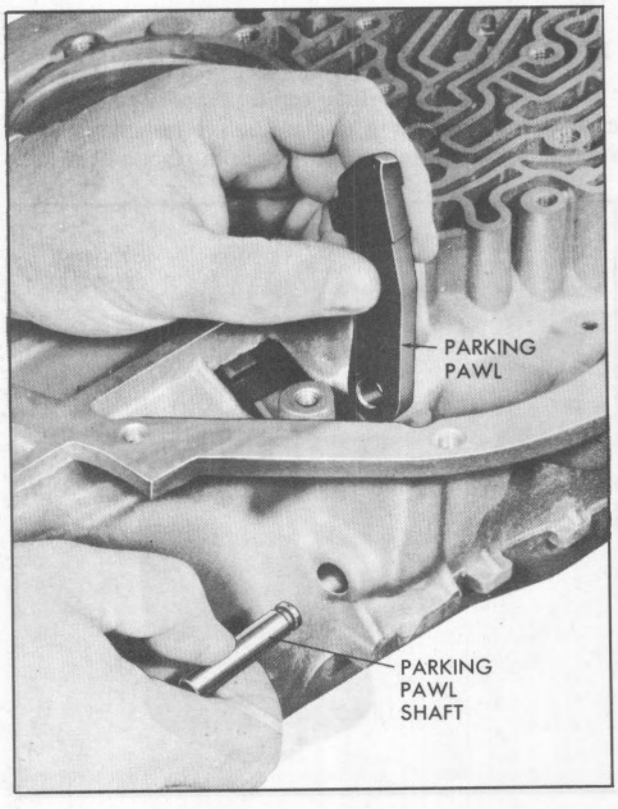


Fig. 7-96 Installing Parking Pawl and Shaft

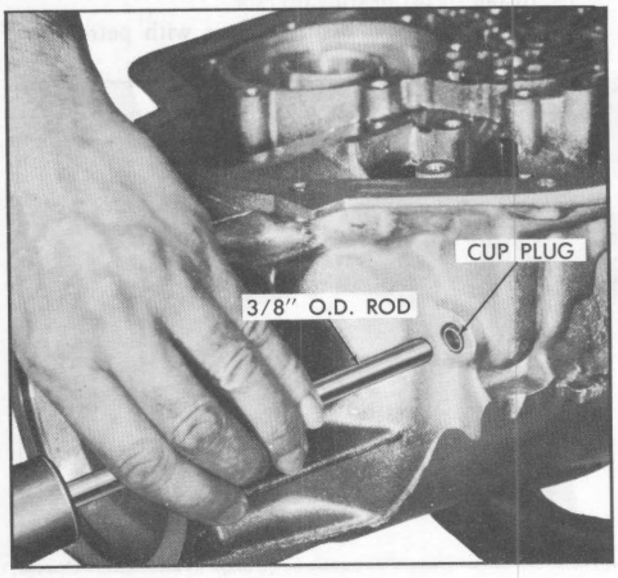


Fig. 7-97 Installing Cup Plug

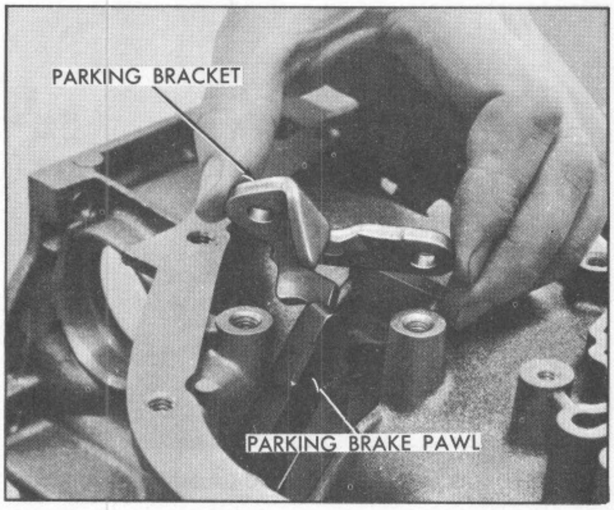


Fig. 7-98 Installing Parking Pawl Bracket

damage to case bushing when installing gear unit assembly.

CAUTION: Be careful not to drop or bump assembly in transmission case during installation. This could result in damage to output shaft case bushing as well as to assembly itself.

8. Install gear unit with center support and reaction carrier, by lining up slots and carefully guiding complete assembly horizontally into transmission case, making certain the center support bolt hole is properly aligned with hole in case.

9. Position transmission vertically with front end of case facing upward. Remove tool, J-21365.

10. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, flat side against center support, locating gap adjacent to front band anchor pin, Fig. 7-99. Expand snap ring until center support is against shoulder of case.

11. Install case to center support bolt.

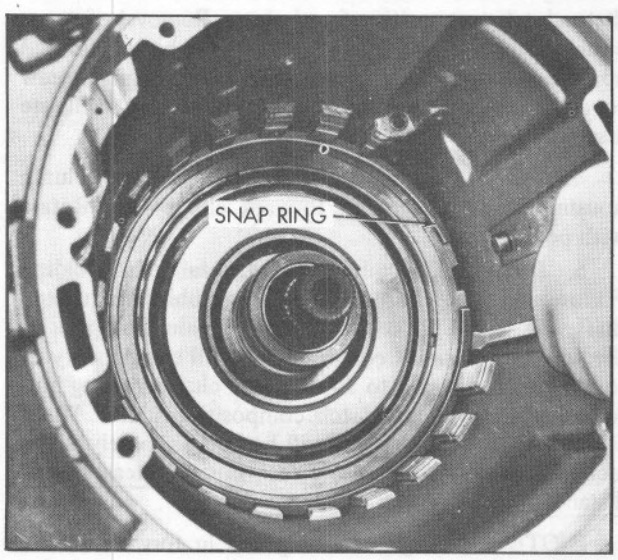


Fig. 7-99 Beveled Snap Ring Location

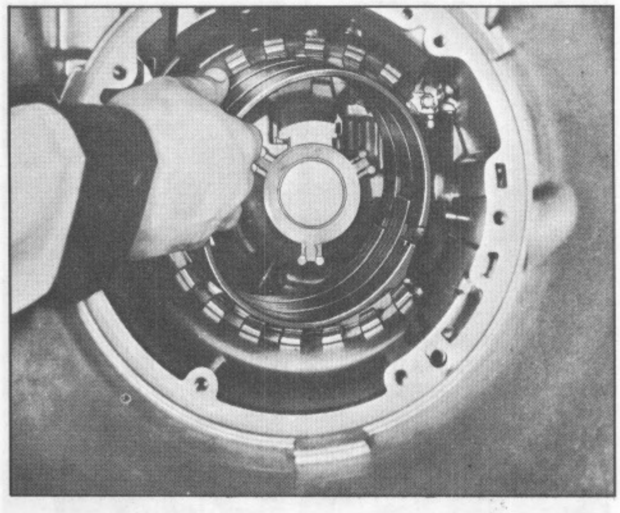


Fig. 7-100 Installing Rear Band Assembly

(NOTE: To correctly perform this operation, it will be necessary to use tool, J-23093 or to make the tool and follow the installation procedure described below.)

Make the tool from 3/8" (.375" diameter) cold roll steel or from a screwdriver with a 3/8" diameter shank. The stock should be approximately 12" long. Grind the stock to a blunt point, tapering it 7/8" from the end of the bar to a 1/8" diameter at the end, Fig. 7-101.

Bend the bar to a 45° angle 2-1/2" from the pointed end, Fig. 7-101.

Place the center support locating tool into the direct clutch passage in the case, with the handle of the tool pointing to the right as viewed from the front of the transmission and parallel to the bell housing mounting face.

Apply pressure downward on the tool handle, which will tend to rotate the center support counterclockwise as viewed from the front of the transmission. While holding the center support firmly counterclockwise against

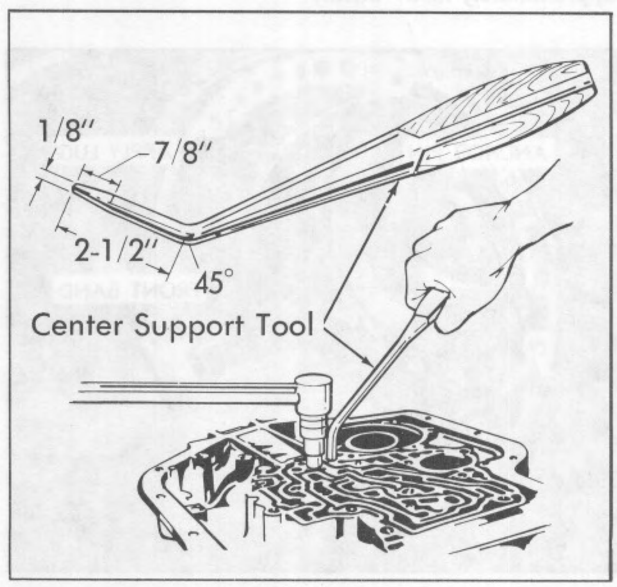


Fig. 7-101 Locating Center Support

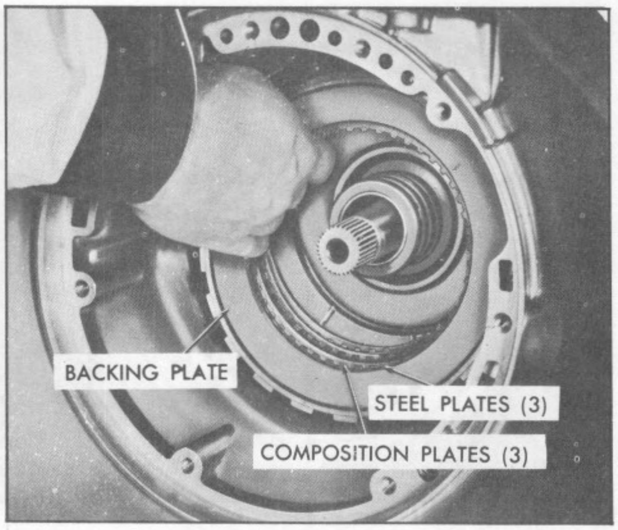


Fig. 7-102 Installing Intermediate Clutch Plates

the case splines, torque the case-to-center support bolt to 23 ft. lbs. using a 3/8" thin wall deep socket.

CAUTION: When using the locating tool, take care not to raise burrs on the case valve body mounting face.

12. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

13. Lubricate three steel and three composition intermediate clutch plates with transmission fluid and install clutch plates in transmission case, Fig. 7-102. Start with the waved steel plate and alternate composition and steel plates.

14. Install intermediate clutch backing plate with flat machined surface against clutch plates.

15. Install backing plate to case snap ring with snap ring gap on side of case opposite front band anchor pin.

(NOTE: Both sides of the snap ring are flat and it is approximately .093" thick.)

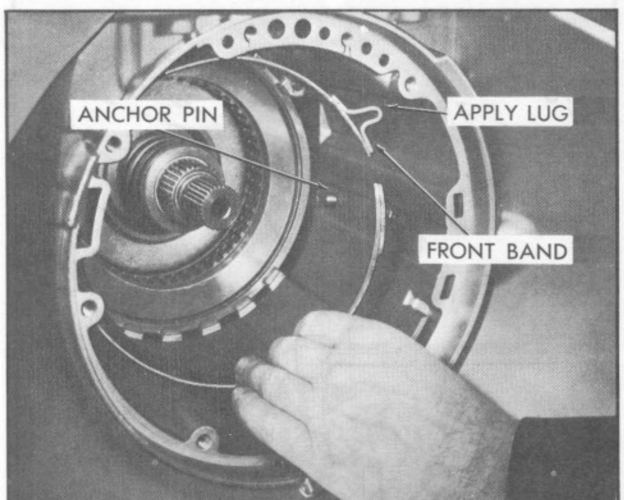


Fig. 7-103 Installing Front Band

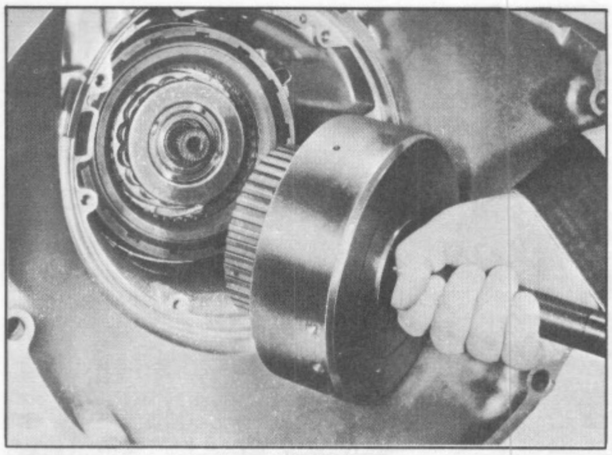


Fig. 7-104 Installing Forward Clutch Assembly

16. Recheck rear unit end play as described in Note 27.

46. Install Front Band and Remaining Clutch Assemblies

1. Inspect front band for cracks or distortion and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

2. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-103.

3. Install direct clutch housing and intermediate roller assembly. Make certain that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing. Clutch Alignment Tool J-24396 is available to position clutch plates for ease of installation.

(NOTE: It will be necessary to rotate clutch housing to allow roller outer race to index with intermediate clutch composition-faced plates. Removal of direct clutch composition and steel plates may be helpful and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.)

4. Install forward clutch hub to direct clutch housing thrust washer on forward clutch hub. Retain with petrolatum.

5. Position transmission horizontally in Holding Fixture and install forward clutch assembly and turbine shaft, Fig. 7-104. Make certain end of main shaft goes all the way into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch composition plates. When forward clutch is seated, it will be approximately 1-1/4 inches from pump mounting face in case. Measure this distance.

(NOTE: Missing internal splines in forward clutch hub are lubrication passages and do not have to be indexed with any particular spline on main shaft.)

47. Install Oil Pump

1. Lubricate turbine shaft journals with transmission fluid and lubricate teflon oil rings on pump delivery sleeve with petrolatum.
2. Install Slide Hammer Bolts, J-6125-1, through two opposite unthreaded holes in pump assembly to serve as guide pins when installing pump.
3. Properly align pump to case gasket on case mounting face.
4. Position pump assembly in transmission case and thread Slide Hammer assemblies into their corresponding threaded holes in transmission case.
5. Install pump assembly in transmission case. Do not remove slide hammer bolts until last two pump attaching screws are installed.
6. Using six new rubber-coated washers on pump attaching screws, install all but one attaching screw at either 5 o'clock or 10 o'clock position so that front unit end play can be rechecked. Tighten screws to 18 foot-pounds.

(NOTE: If turbine shaft cannot be rotated as pump is being pulled into place, the forward or direct clutch housings have not been installed properly to index with all the clutch plates. This condition must be corrected before pump is pulled fully into place.)

7. Recheck front unit end play as described in Note 23.
8. Install remaining pump attaching screw using new rubber coated washer. Tighten screw to 18 foot-pounds.
9. Apply non-hardening sealer to outside of new seal and install new front seal using Pump Oil Seal Installer, J-21359.

48. Install Parking Linkage, Detent Lever, and Manual Shaft

1. If necessary install a new manual shaft lip seal into transmission case using a 3/4" diameter rod to seat the seal.
2. Insert actuator rod into manual detent lever from side opposite pin.

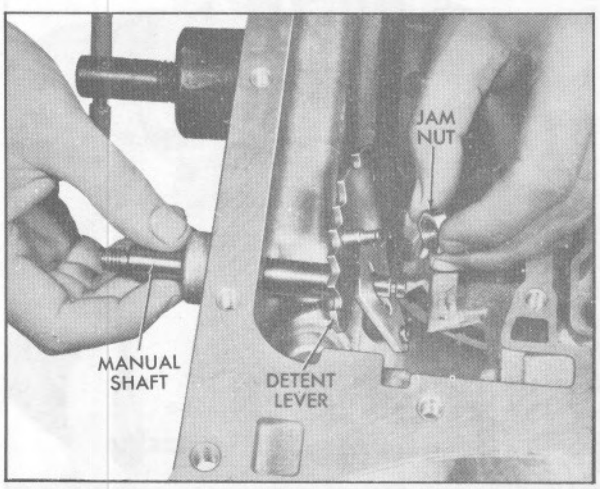


Fig. 7-105 Installing Manual Shaft

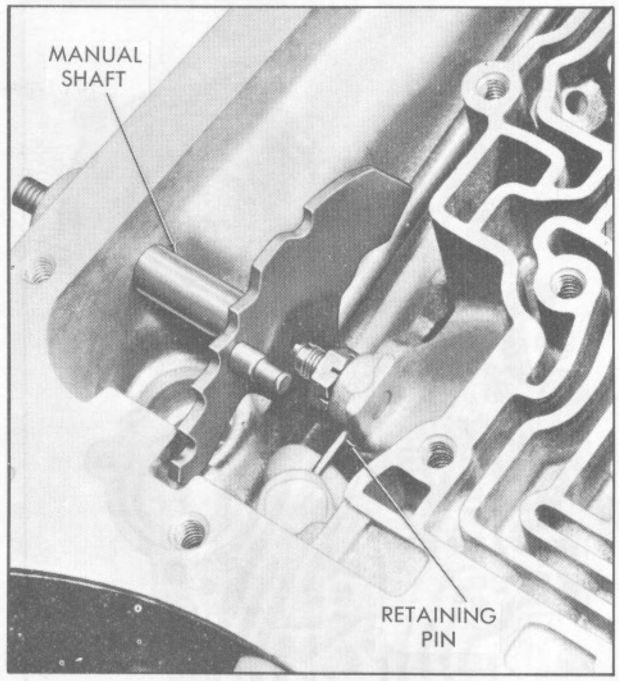


Fig. 7-106 Retaining Pin

3. Install actuator rod plunger under parking bracket and over parking pawl.
4. Install manual shaft into case and through detent lever, Fig. 7-105.
5. Install locknut on manual shaft. Tighten nut to 18 foot-pounds.
6. Install external manual yoke on manual shaft if removed. Tighten nut to 18 foot-pounds.
7. Install retaining pin in case, indexing it with groove in manual shaft, Fig. 7-106.

(NOTE: If procedure is being performed with transmission in car, install and straighten bent pin.)

49. Install Extension Housing

1. Install new gasket on extension housing, retaining with petrolatum.
2. Check O-ring on output shaft for any nicks or flattening and replace O-ring if either condition exists.
3. Secure extension housing to case with six attaching screws. Tighten screws to 23 foot-pounds.
4. If necessary, install a new extension housing oil seal using Oil Seal Installer, J-21359. Apply non-hardening sealer to outside of seal before installation.

50. Install Check Balls, Control Valve, Spacer Plate & Gaskets, Detent Solenoid, Front Servo Assembly and Electrical Connector

1. Install two control valve assembly attaching bolts with heads cut off as guide pins as shown in Fig. 7-111.

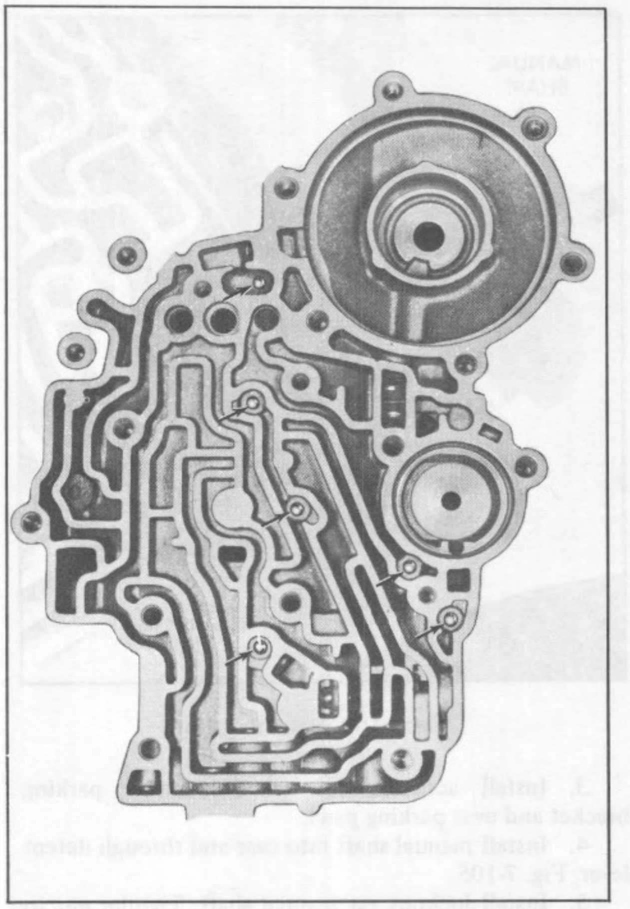


Fig. 7-107 Location of Check Balls

2. Install six check balls into ball seat pockets in transmission case. Fig. 7-107.

(NOTE: If transmission is in car, install check balls into ball seat pockets on spacer plate, Fig. 7-108.)

3. Install control valve spacer plate-to-case gasket (gasket with extension for detent solenoid and a "C" near front servo location).

4. Install control valve spacer plate.

5. Install detent solenoid gasket.

6. Install detent solenoid assembly with connector facing outer edge of case. Do not tighten bolts at this time.

7. Install front servo spring and spring retainer into transmission case.

8. Install retainer ring in front servo pin groove and install pin into case so that tapered end contacts band. Make certain retainer ring is installed in servo pin groove.

9. Install seal ring on servo piston, if removed, and install on servo pin with flat side of piston positioned toward bottom pan.

(NOTE: The teflon ring allows the front servo piston to slide very freely in the case. The free fit of the ring in the bore is a normal characteristic and does not indicate leakage during operation. The teflon ring should only be replaced if it shows damage or if evidence of leakage during operation exists.)

(NOTE: If transmission is in car, assembly front

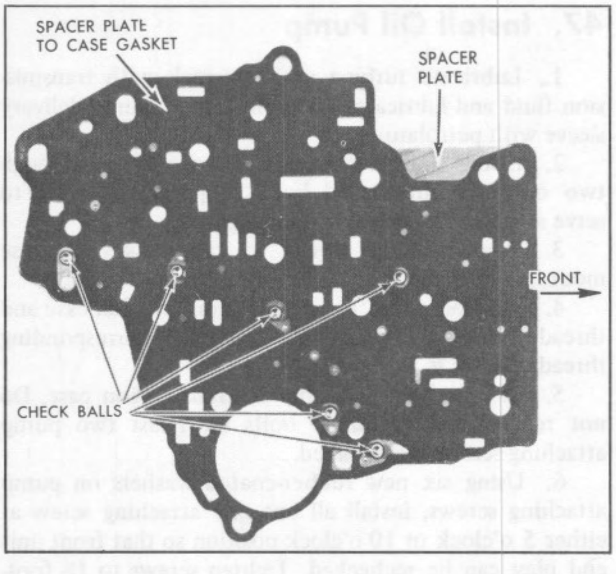


Fig. 7-108 Spacer Plate Gasket With Check Balls

servo group as shown in Figure 7-52 and install this group of parts into front servo bore in case and hold. Slip a length of straight, clean feeler gauge or shim stock (about .020") between spacer plate and front servo piston to temporarily retain front servo group.)

10. Install new O-ring on solenoid connector.

11. Install connector with lock tabs pointing into case. Position locator tab in notch on side of case.

12. Connect detent solenoid wire to connector terminal, Fig. 7-110.

51. Install Rear Servo Assembly

1. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and install rear accumulator spring in servo inner bore.

(NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin

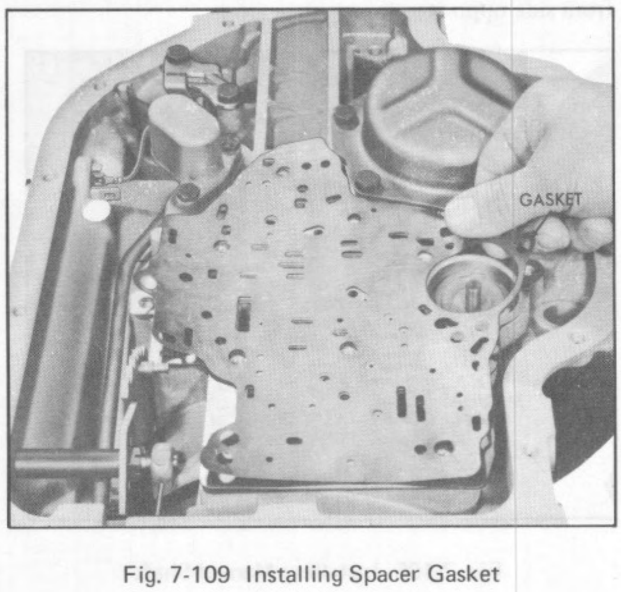


Fig. 7-109 Installing Spacer Gasket

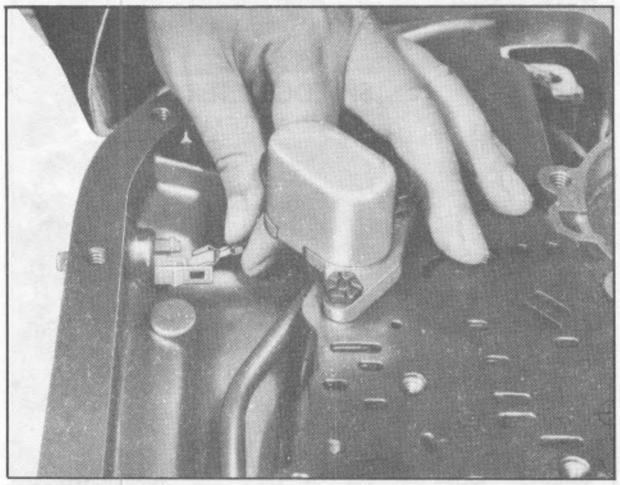


Fig. 7-110 Installing Wire onto Electrical Connector

bore in transmission case. Otherwise servo pin will not apply band.)

2. Position rear servo assembly in transmission.
3. Press down on rear servo assembly, making certain it is properly seated in case bore, and install rear servo cover and new gasket. Install six attaching screws, tightening screws to 18 foot-pounds.

52. Install Control Valve Assembly, Governor Pipes & Governor Screen Assembly

1. Install control valve assembly-to-spacer gasket (gasket with "VB" near front servo location).
2. Install governor pipes on control valve assembly. Governor pipes are interchangeable.
3. Install governor screen assembly, open end first; into governor feed pipe hole in case (hole nearest the center of transmission). Fig. 7-28.
4. Install control valve assembly and governor pipes on transmission, while carefully aligning the governor feed pipe over the governor screen, Fig. 7-111. Make

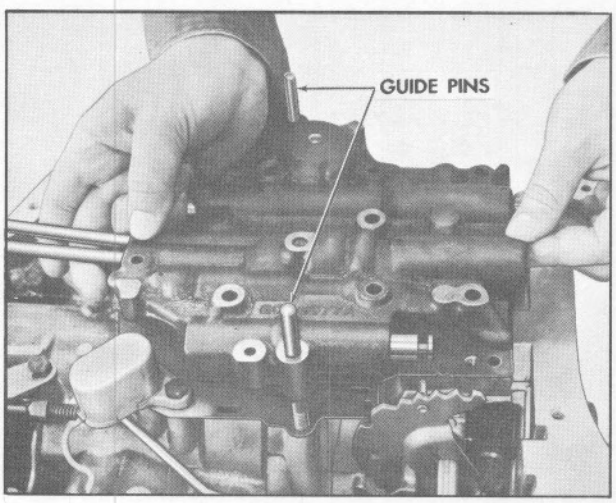


Fig. 7-111 Installing Control Valve Assembly

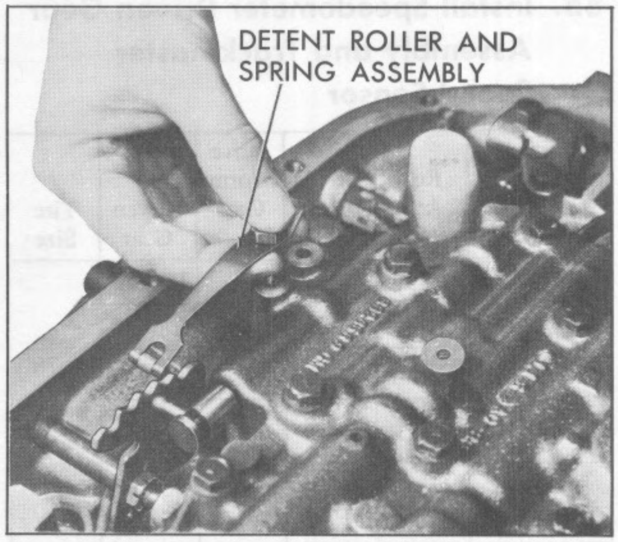


Fig. 7-112 Installing Detent Roller and Spring

certain gaskets and spacer do not become mispositioned. See Fig. 7-109.

(NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipes to make certain they are properly seated in case holes.)

5. Start control valve assembly attaching bolts.

(NOTE: If transmission is in vehicle, remove feeler stock before tightening any control valve bolts.)

6. Remove guide pins and install detent roller and spring assembly and remaining bolts, Fig. 7-112. Torque bolts to 8 ft. lbs.

7. Tighten detent solenoid attaching screws to 10 foot-pounds. Solenoid screws should be zinc plated to provide a good electrical connection.

53. Install Modulator Valve and Vacuum Modulator

1. Install modulator valve into case with stem end out.
2. Install new O-ring on vacuum modulator.
3. Install vacuum modulator into case with vacuum hose pipe facing front of car and angled 5° toward top of case.
4. Install modulator retainer with curved side of tangs, inboard and install attaching screw. Tighten screw to 18 foot-pounds.

54. Install Governor Assembly

1. Install governor assembly into case.
2. Using a new gasket, attach governor cover to case with four attaching screws. Torque screws to 18 foot-pounds.

(NOTE: If transmission is in car proceed as follows.)

3. Install two bolts securing transmission extension housing to cross member.

55. Install Speedometer Driven Gear Assembly and Trackmaster Speed Sensor

Series	Rear Axle Ratio	Driven Gear Teeth	Drive Worm Gear Teeth	Color of Driven Gear	Tire Size
Brougham	2.73:1	35	18	Pink	
Calais or	2.93:1	38	18	Blue	
DeVille	3.15:1	41	18	Yellow	L-78
Limousine	3.15:1	40	18	Black	
Commercial Chassis	3.15:1	38	18	Blue	8.90

Speedometer driven gears are provided in three different tooth sizes. Driven gear and matching sleeve must be installed to correspond with axle ratio. Refer to chart above to select proper gear.

1. Lubricate driven gear selected from above chart with a small amount of DEXRON® or DEXRON®-II transmission fluid and position driven gear as shown in Fig. 7-113.

2. Install speedometer driven gear retainer with tangs in sleeve positioning bosses, and install attaching screw. Tightening screw to 18 foot-pounds.

CAUTION: Never turn sleeve in transmission case as shaft centerline is eccentric with outside diameter and gear damage will result.

56. Install Intake Pipe and Filter Assembly and Bottom Pan

1. Install new intake pipe O-ring onto pipe and install pipe assembly into new filter assembly.

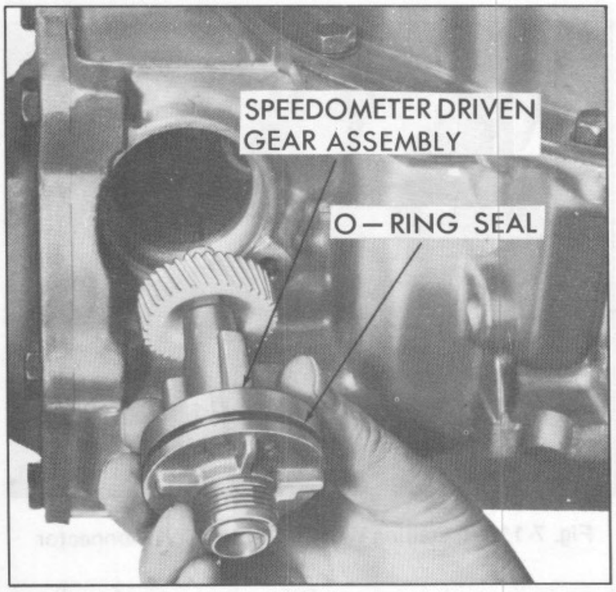


Fig. 7-113 Installing Speedometer Driven Gear

2. Install filter and intake pipe assembly into case bore, Fig. 7-26.

3. Install filter retainer bolt, and tighten to 10 foot-pounds. Fig. 7-25.

4. Install new gasket on bottom pan and install bottom pan.

5. Install 13 bottom pan attaching screws. Tighten screws to 12 foot-pounds.

57. Install Converter

1. Install converter on turbine shaft making certain that converter drive hub slots are fully engaged with the pump drive gear tangs.

2. Install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20.

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot Pounds
260M	Filter to Valve Body Screw	5/16-18	10
280M	Solenoid to Case Screw	1/4-20	10
260M	Control Valve Assembly to Case Screw	1/4-20	8
		5/16-18	8
Special	Line Pressure Plug	1/8 Pipe	10
601M	Flywheel Housing Cover to Transmission Screw	1/4-20	5
280M	Pump Body to Cover Screw	5/16-18	18
280M	Pump Assembly to Case Screw	5/16-18	18
280M	Rear Servo Cover to Case Screw	5/16-18	18
260M	Governor Cover to Case	5/16-18	18
280M	Parking Pawl Bracket to Case Screw	5/16-18	18
260M	Vacuum Modulator Retainer to Case Screw	5/16-18	18
260M	Speedometer Driven Gear Retainer to Case Screw	5/16-18	18
1010-1020	Oil Pan to Case Screw	5/16-18	12
260M	Extension Housing to Case Screw	3/8-16	23
286M	Manual Shaft to Detent Lever Nut	3/8-24	18
286M	Manual Yoke to Manual Shaft Nut	3/8-16	18
300M	Case to Center Support Screw	3/8-16	23
300M	Flywheel to Converter Screw	3/8-16	30
280M	Transmission Case to Engine Screw	3/8-16	35
Steel	Oil Cooler Pipe Connector Nut at Case and Radiator	1/2-20	20
Steel	Cooler Pipe Connector at Case	1/4 Pipe	30
280M	Engine Rear Mount to Transmission	7/16-14	55
280M	Engine Rear Support Bracket to Frame Bolt	3/8-16	30

NOTE: Refer to back of Manual for bolt and nut markings and steel classifications.

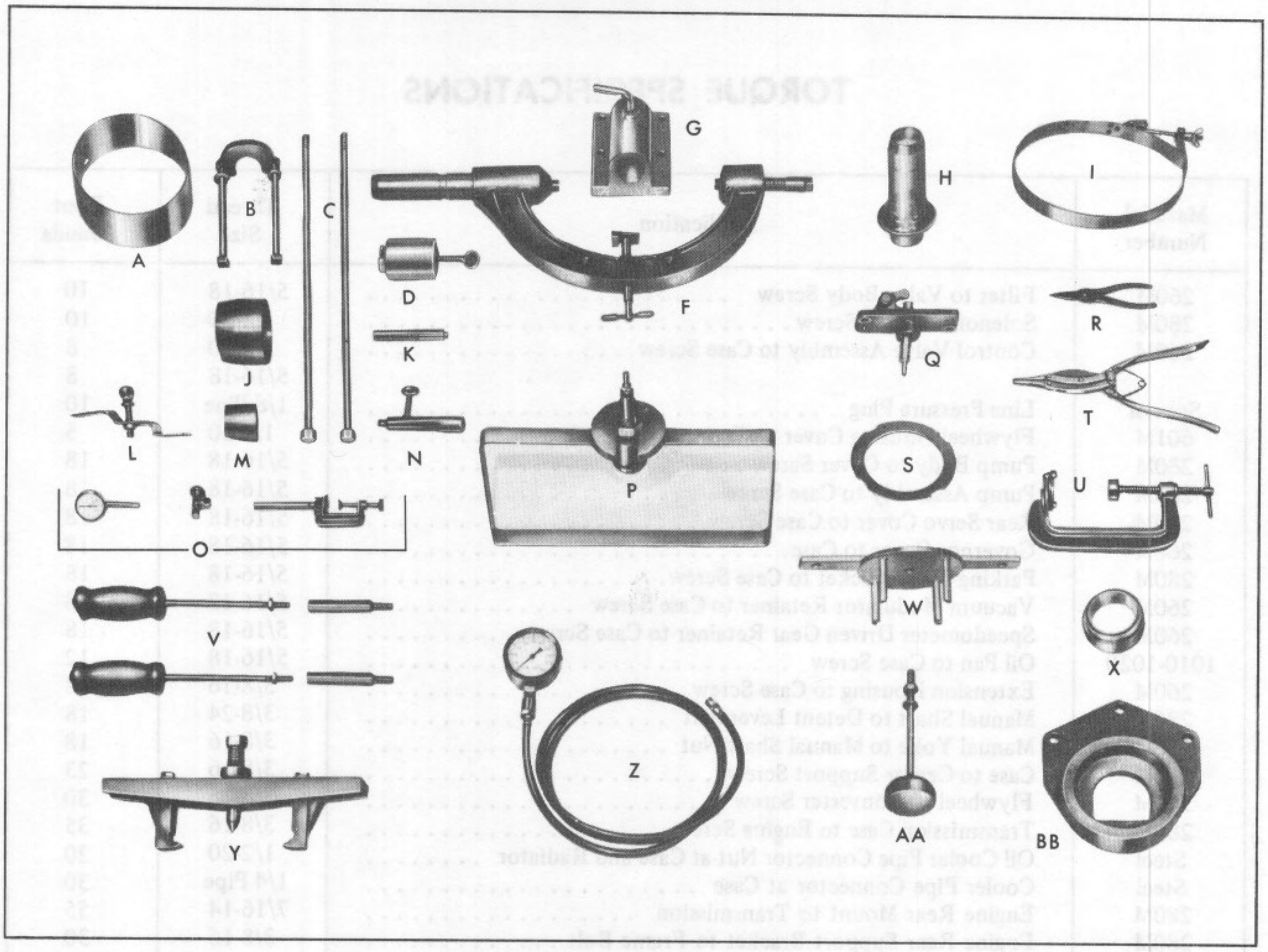


Fig. 7-114 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21409	Forward and Direct Clutch Piston Installer	M	J-21362	Forward and Direct Clutch Inner Seal Protector
B	J-21427	Speedometer Drive Gear Remover	N	J-21361	Pump Check Valve Seat Remover
			O	J-8001	Dial Indicator Set
C	J-21797	Speedometer Drive Gear Remover Bolts	P	J-21369	Converter Leak Test Fixture
			Q	J-21370	Band Apply Pin Selector Gage (Use J-21370-5 Pin)
D	J-21795	Gear Assembly Remover and Installer Adapter			
			R	J-5403	Snap Ring Pliers (#21)
F	J-8763	Transmission Holding Fixture	S	J-21664	Clutch Spring Compressor Adapter
G	J-3289-01	Holding Fixture Base			
H	J-21359	Pump Oil and Extension Housing Seal Installer	T	J-8059	Snap Ring Pliers
			U	J-21885	Control Valve Accumulator Piston Installer
I	J-21368	Pump Body and Cover Alignment Band			
			V	J-6125	Slide Hammer Assemblies
J	J-21363	Intermediate Clutch Inner Seal Protector	W	J-4670	Clutch Spring Compressor
			X	J-21364	Rear Unit Holding Fixture Adapter
K	J-21360	Pump Check Valve Seat Installer	Y	J-8433	Pulley Puller
L	J-21366	Converter Holding Clamp	Z	J-5907	0-300 PSI Pressure Gage
			AA	J-6129	Rear Clutch Spring Compressor
			BB	J-6116	Rear Unit Holding Fixture

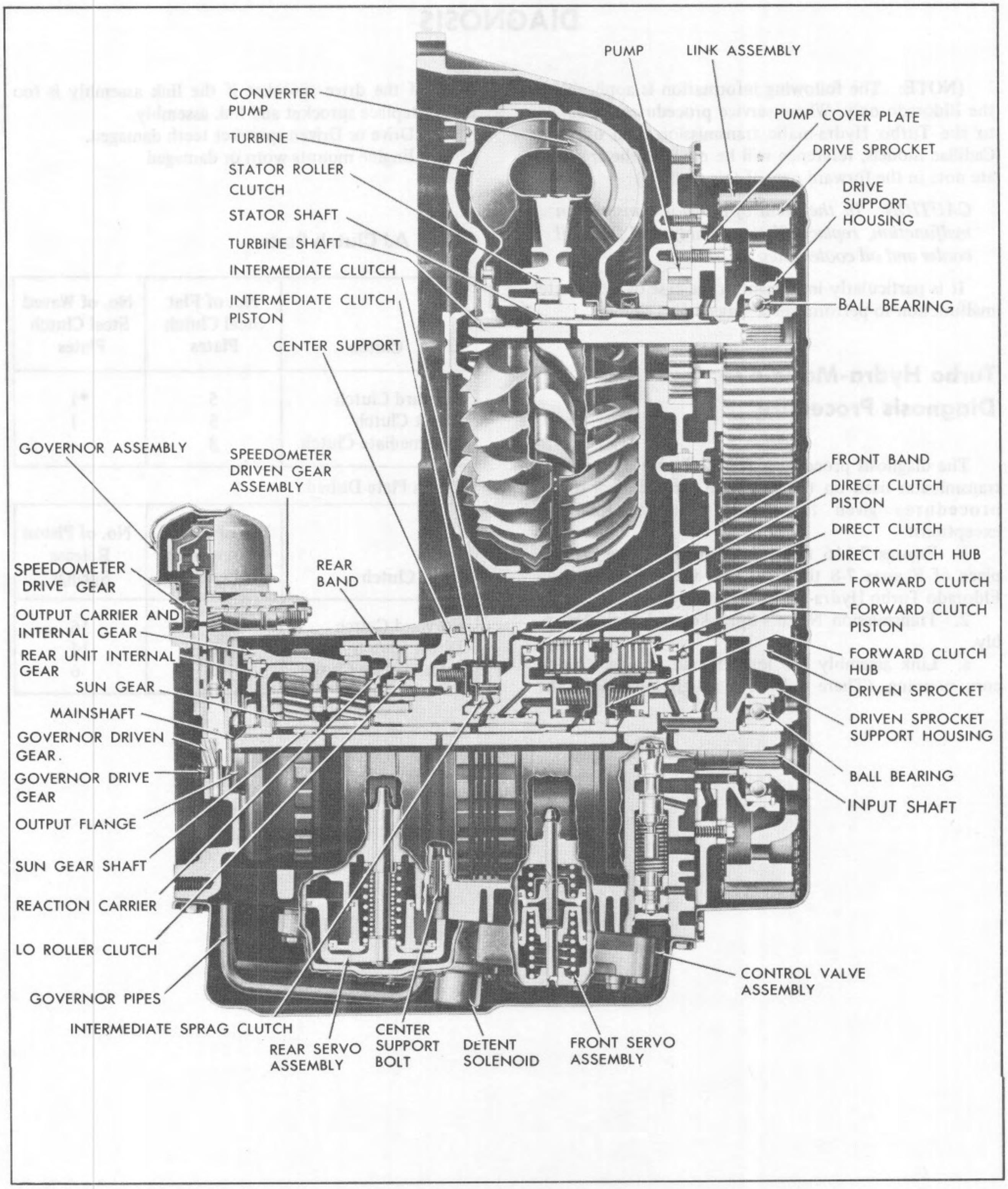


Fig. 7-115 Turbo Hydra-Matic Transmission-Cutaway View

(NOTE: The following information pertains only to the Eldorado.)

The model AJ Turbo Hydra-matic transmission, Fig. 7-115, used on the Eldorado is a fully automatic transmission used for front wheel drive applications.

The 1974 transmission is similar to 1973. Refer to the 1973 shop manual for information pertaining to theory of operation, hydraulic system description, valve and hydraulic control functions and oil circuit diagrams.

DIAGNOSIS

(NOTE: The following information is applicable to the Eldorado only. Where service procedures are similar to the Turbo Hydra-matic transmission used on other Cadillac models, reference will be made to the appropriate note in the forward part of this section.)

CAUTION: In the event of a major transmission malfunction, replace filter assembly and flush oil cooler and oil cooler lines.

It is particularly important in the case of a converter malfunction to perform these service procedures.

Turbo Hydra-Matic 425 Diagnosis Procedure

The diagnosis procedures for the Turbo Hydra-matic transmission used on the Eldorado are identical to the procedures given for C-car, with the following exceptions:

1. Figures 7-116 through 7-120 are to be used in place of Figures 7-8 through 7-12, when diagnosing an Eldorado Turbo Hydra-matic transmission.

2. Transmission Noise - Sprocket and Link Assembly.

a. Link assembly too long. Sounds similar to pop corn popping. (There will be a rough burr along the teeth of the drive sprocket if the link assembly is too long). Replace sprocket and link assembly.

b. Drive or Driven sprocket teeth damaged.

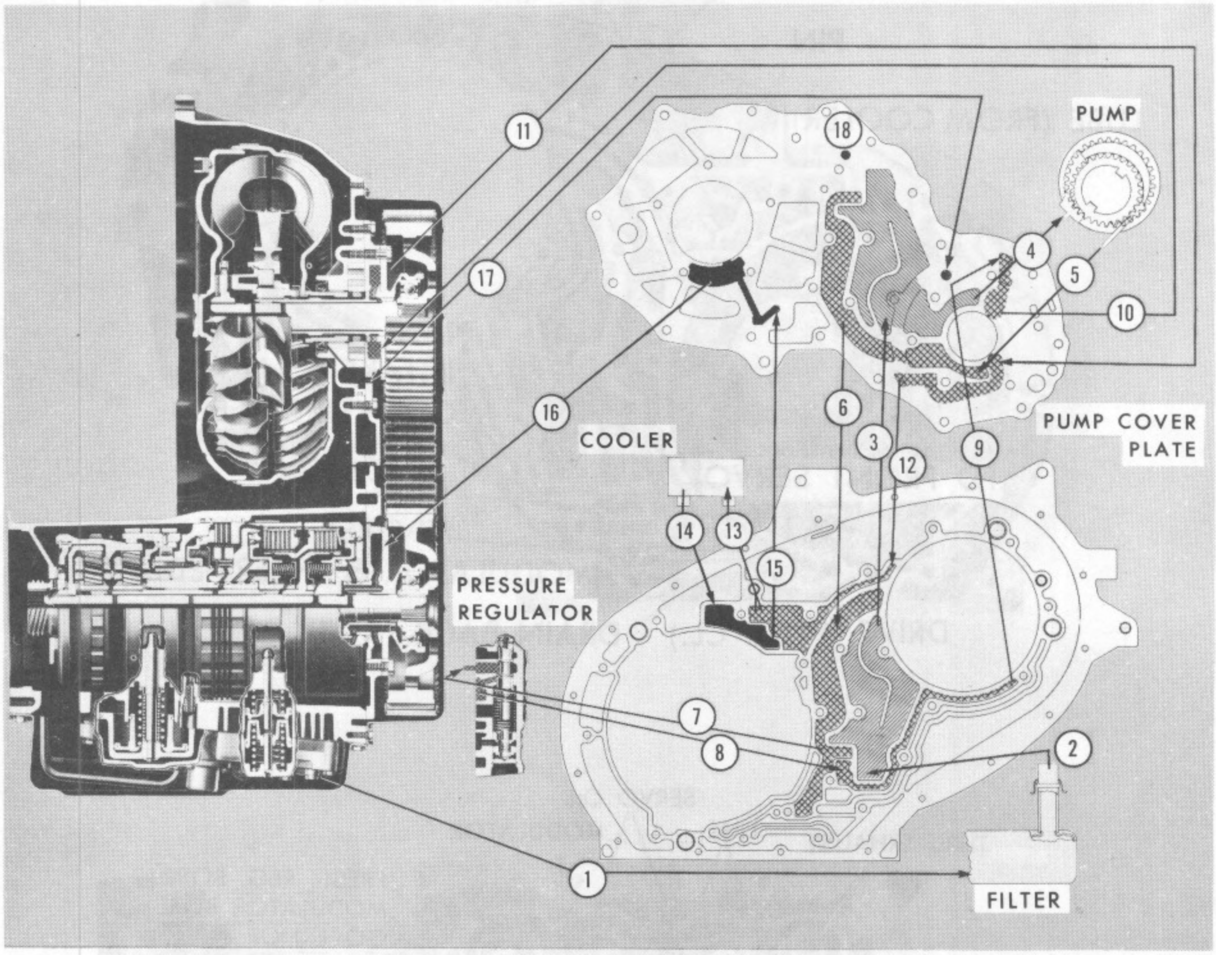
c. Engine mounts worn or damaged.

Model AJ Clutch Parts

Clutch	No. of Flat Steel Clutch Plates	No. of Waved Steel Clutch Plates
Forward Clutch	5	*1
Direct Clutch	5	1
Intermediate Clutch	3	-

*Clutch Plate Dished

Clutch	No. of Clutch Composition Plates	No. of Piston Release Springs
Forward Clutch	5	16
Direct Clutch	6	14
Intermediate Clutch	3	6



1 OIL FROM SUMP TO FILTER
2 FILTER TO CASE PASSAGE
3 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
4 PUMP COVER PLATE PASSAGE TO PUMP
5 PUMP TO PUMP COVER PLATE PASSAGE
6 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
7 CASE PASSAGE TO PRESSURE REGULATOR VALVE
8 PRESSURE REGULATOR VALVE TO CASE PASSAGE
9 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
10 PUMP COVER PLATE PASSAGE TO CONVERTER
11 CONVERTER TO PUMP COVER PLATE PASSAGE
12 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
13 CASE PASSAGE TO COOLER
14 COOLER RETURN TO CASE PASSAGE
15 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
16 PUMP COVER PLATE PASSAGE TO TRANSMISSION POWER TRAIN (ALL INTERNAL LUBRICATION)
NOTE: THE NUMBERS IN THE CROSS SECTION INDICATE THAT THERE ARE ADDITIONAL LUBRICATION HOLES IN THIS AREA THAT ARE NOT SHOWN IN THE CROSS SECTION
17 FRONT SEAL DRAIN BACK HOLE
18 PRESSURE REGULATOR VENT HOLE

Fig. 7-116 Lubrication Chart

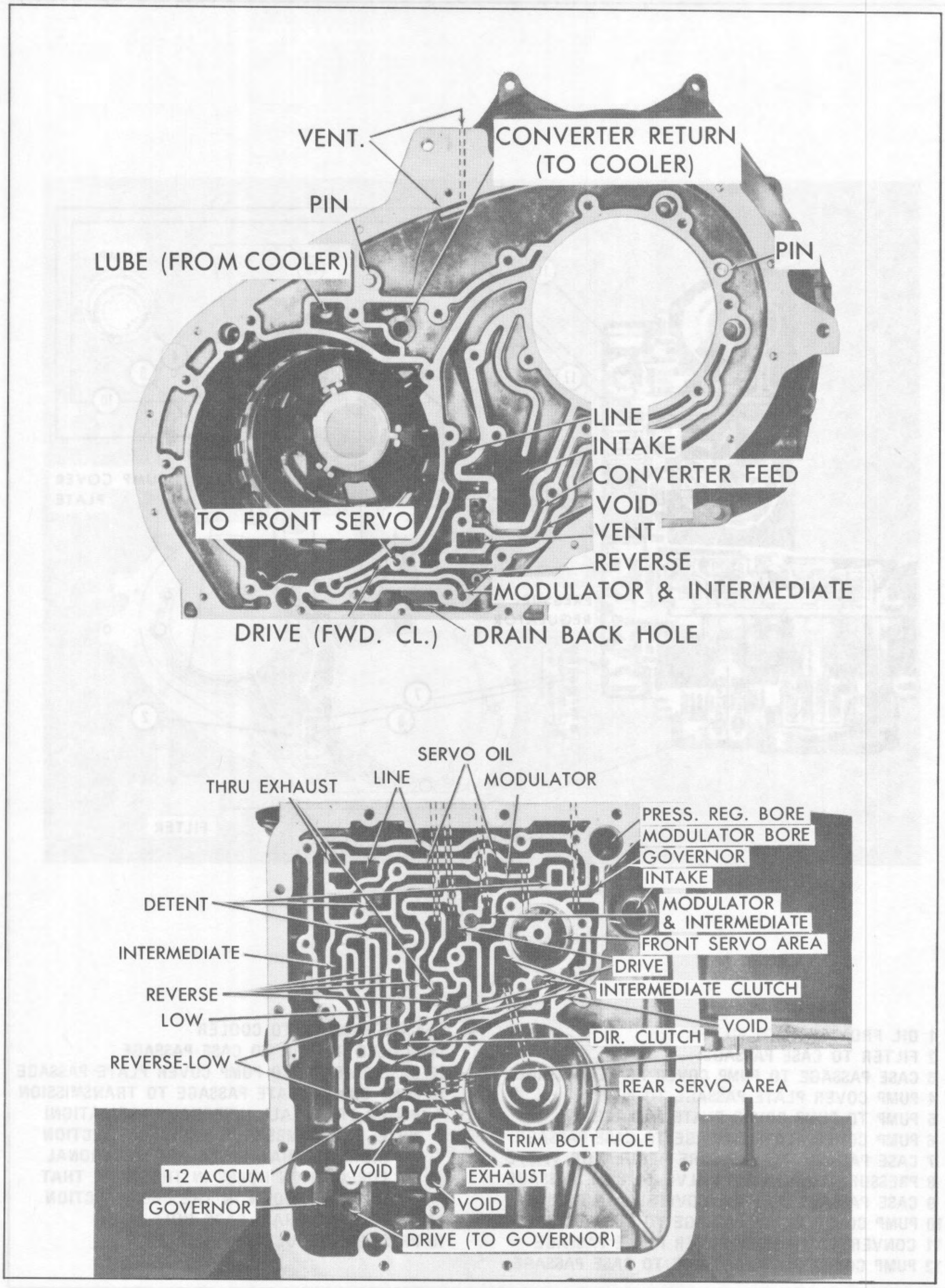


Fig. 7-117 Case Oil Passages–Front and Bottom Views

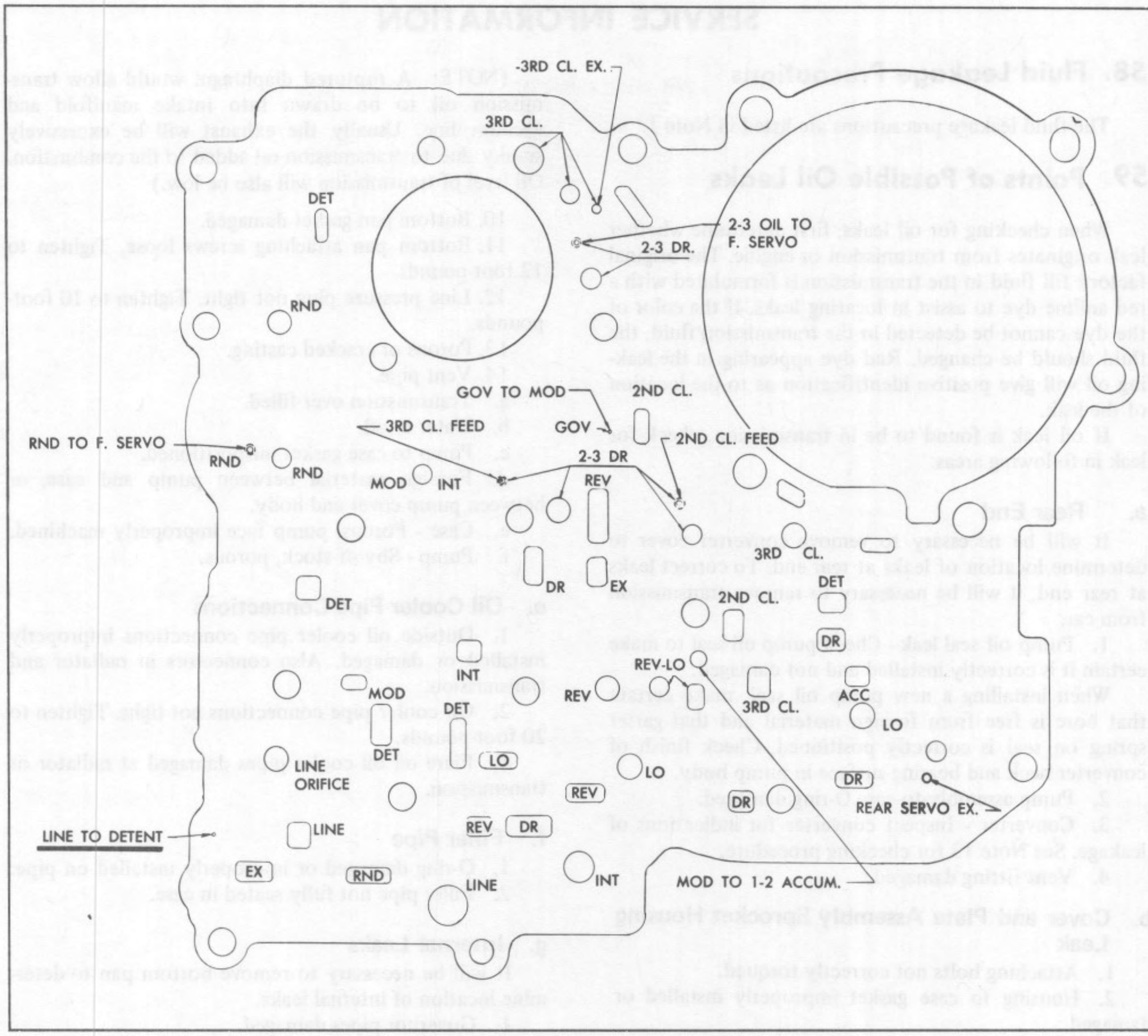


Fig. 7-118 Spacer For Control Valve Assembly

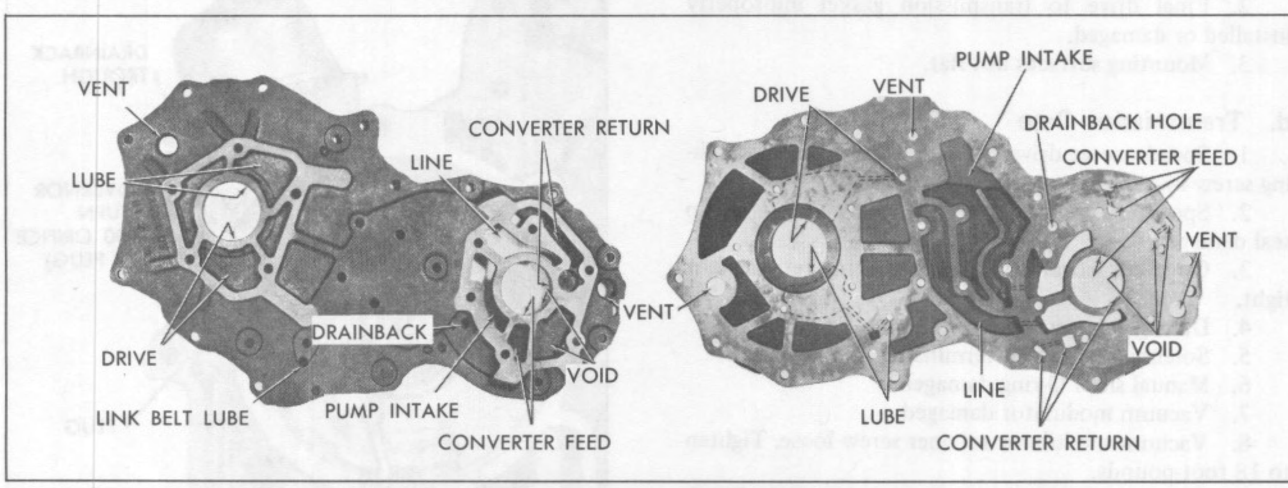


Fig. 7-119 Pump Cover Oil Passages

SERVICE INFORMATION

58. Fluid Leakage Precautions

The fluid leakage precautions are listed in Note 1.

59. Points of Possible Oil Leaks

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. If the color of the dye cannot be detected in the transmission fluid, the fluid should be changed. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

If oil leak is found to be in transmission, check for leak in following areas:

a. Rear End

It will be necessary to remove converter cover to determine location of leaks at rear end. To correct leaks at rear end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case O-ring damaged.
3. Converter - Inspect converter for indications of leakage. See Note 13 for checking procedure.
4. Vent fitting damaged.

b. Cover and Plate Assembly Sprocket Housing Leak

1. Attaching bolts not correctly torqued.
2. Housing to case gasket improperly installed or damaged.
3. Housing to case gasket face not flat.

c. Final Drive to Transmission Leak

1. Attaching bolts not correctly torqued.
2. Final drive to transmission gasket improperly installed or damaged.
3. Mounting surfaces not flat.

d. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.
2. Speedometer driven gear housing O-ring or lip seal damaged.
3. Governor cover bale-type attaching retainer not tight.
4. Damaged governor O-ring.
5. Solenoid connector terminal O-ring damaged.
6. Manual shaft O-ring damaged.
7. Vacuum modulator damaged.
8. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.
9. Vacuum modulator diaphragm damaged. Check as described in Diagnosis Part V.

(NOTE: A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion. Oil level of transmission will also be low.)

10. Bottom pan gasket damaged.
11. Bottom pan attaching screws loose, Tighten to 12 foot-pounds.
12. Line pressure plug not tight. Tighten to 10 foot-pounds.
13. Porous or cracked casting.
14. Vent pipe.

a. Transmission over-filled.
b. Water in oil.
c. Pump to case gasket mispositioned.
d. Foreign material between pump and case, or between pump cover and body.
e. Case - Porous, pump face improperly machined.
f. Pump - Shy of stock, porous.

e. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.
2. Oil cooler pipe connections not tight. Tighten to 20 foot-pounds.
3. Flare on oil cooler pipes damaged at radiator or transmission.

f. Filler Pipe

1. O-ring damaged or improperly installed on pipe.
2. Filler pipe not fully seated in case.

g. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.

1. Governor pipes damaged.
2. Control valve assembly-to-spacer or case gaskets damaged.

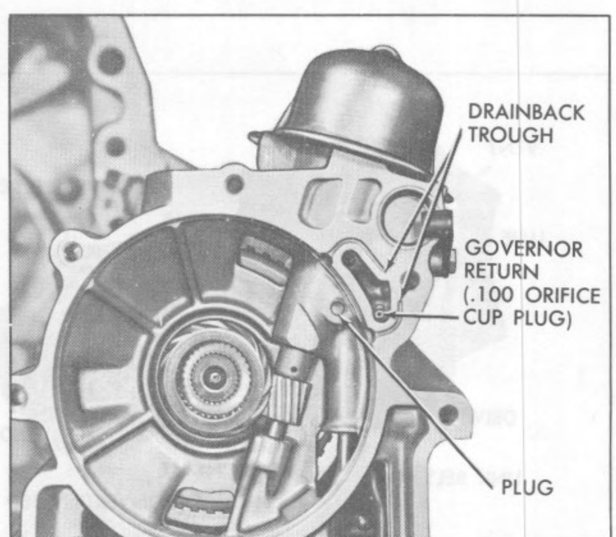
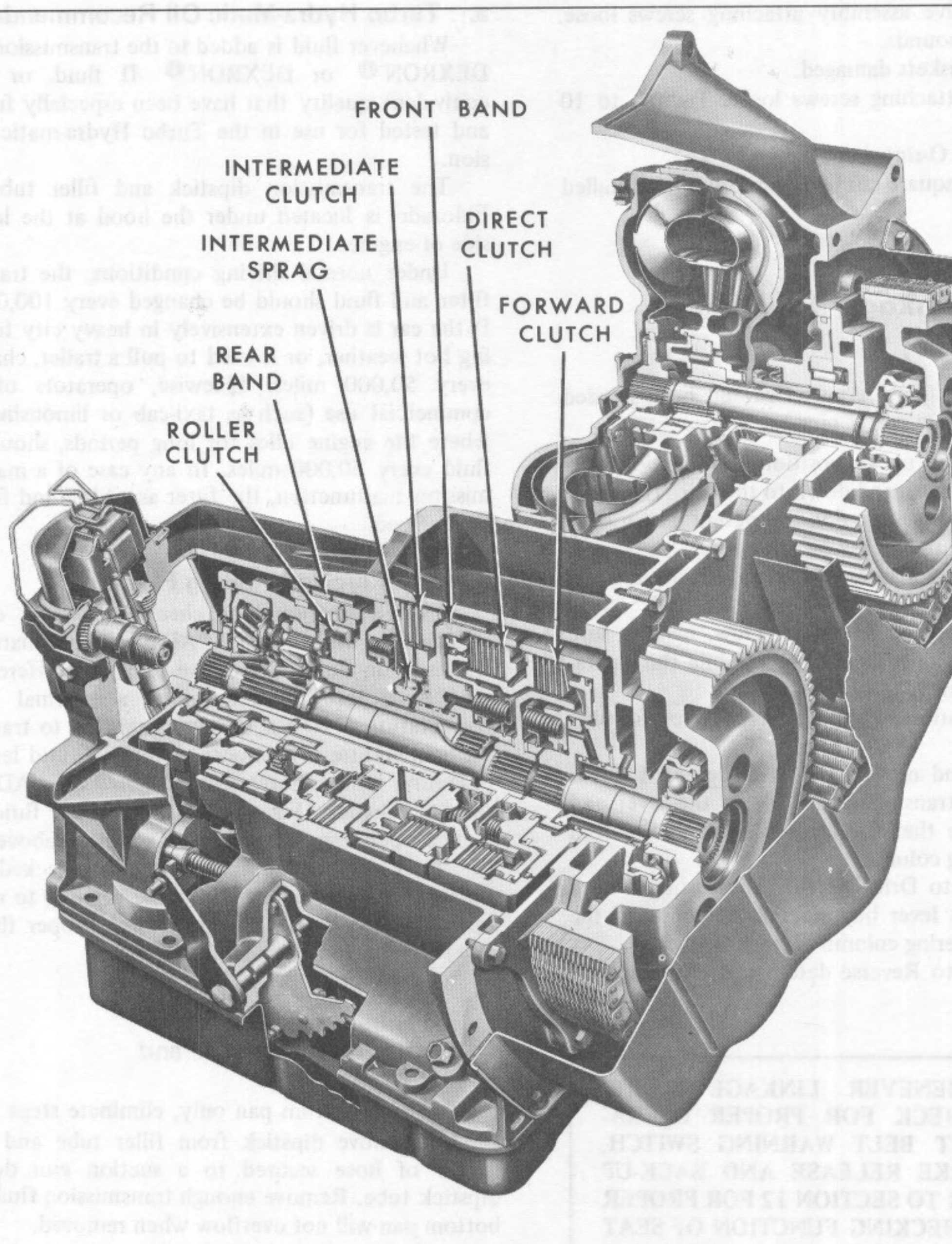


Fig. 7-120 Governor Oil Passages



SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	FRONT BAND	INT. CLUTCH	INT. SPRAG	ROLLER CLUTCH	REAR BAND
PARK—NEUT.	60-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE 1	60-150	ON	OFF	OFF	OFF	OFF	ON	OFF
LEFT 2	60-150	ON	OFF	OFF	ON	ON	OFF	OFF
3	60-150	ON	ON	OFF	ON	OFF	OFF	OFF
DRIVE 1	150	ON	OFF	OFF	OFF	OFF	ON	OFF
RIGHT 2	150	ON	OFF	ON	ON	ON	OFF	OFF
LO	150	ON	OFF	OFF	OFF	OFF	ON	ON
2	150	ON	OFF	ON	ON	ON	OFF	OFF
REV.	95 - 230	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-121 Band, Sprag, Roller Clutch and Clutch Application Chart

3. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.
4. Solenoid gaskets damaged.
5. Solenoid attaching screws loose. Tighten to 10 foot-pounds.
6. Intake pipe O-ring damaged.
7. Rear servo square cut O-ring improperly installed or damaged.

60. Manual Linkage Adjustment (Fig. 7-122)

(NOTE: Cotter pins removed should be discarded and replaced with new cotter pins.)

1. Pull relay rod up to position transmission shift valve in Park, then push rod down to the third (Neutral) step. Make sure rod is centered in this detent position.
2. Loosen adjusting screw on relay lever.
3. Position selector lever in Neutral detent in steering column.
4. Tighten relay rod adjusting screw, making sure shift lever is held against Neutral stop while this operation is being performed.
5. Check operation of selector lever by performing the following steps:

a. Lift lever and move to Neutral detent. (This is the detent in the transmission.) Release the lever and check to make sure that the lever fits into the neutral notch in the steering column.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

WARNING: WHENEVER LINKAGE IS READJUSTED, CHECK FOR PROPER OPERATION OF SEAT BELT WARNING SWITCH, PARKING BRAKE RELEASE AND BACK-UP LIGHTS. REFER TO SECTION 12 FOR PROPER METHOD OF CHECKING FUNCTION OF SEAT BELT WARNING SWITCH.

61. Transmission Downshift Switch Adjustment

The procedure for adjusting the transmission downshift switch is described in Note 4.

62. Checking and Adding Fluid

(When checking fluid level the oil temperature and having the car on a level surface are particularly important. Careful attention to the following procedures is necessary in order to determine the actual fluid level.

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added to the transmission use only DEXRON® or DEXRON® -II fluid, or fluids of equivalent quality that have been especially formulated and tested for use in the Turbo Hydra-matic transmission.

The transmission dipstick and filler tube on the Eldorado is located under the hood at the left center side of engine.

Under normal driving conditions, the transmission filter and fluid should be changed every 100,000 miles. If the car is driven extensively in heavy city traffic during hot weather, or is used to pull a trailer, change fluid every 50,000 miles. Likewise, operators of cars in commercial use (such as taxi-cab or limousine service) where the engine idles for long periods, should change fluid every 50,000 miles. In any case of a major transmission malfunction, the filter assembly and fluid must be replaced.

b. Checking and Adding Fluid

Fluid level should be checked at every engine oil change. The full "F" and "ADD" dimple marks on the transmission dipstick indicate one pint difference. Correct fluid level is determined at normal operating temperature (170°F). Careful attention to transmission oil temperature is necessary, as proper fluid level at low operating temperatures will be below the "ADD" mark on the dipstick, Fig. 7-123, and proper fluid level at higher operating temperatures will rise above the full "F" mark. Fluid level must always be checked with car on level surface, and with engine running to make certain converter is full. To determine proper fluid level. See Note 5b. for procedure.

c. Draining Bottom Pan and Replacing Intake Pipe and Filter Assembly

To drain bottom pan only, eliminate steps 5 and 6.

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the dipstick tube. Remove enough transmission fluid so that bottom pan will not overflow when removed.
2. Raise car on hoist or place on jack stands, and provide container to collect draining oil.
3. Remove bottom pan and gasket. Discard gasket.
4. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.
5. Remove intake pipe and filter assembly. Remove and discard intake pipe O-ring.
6. Install new intake pipe O-ring into pipe bore in transmission case and install new intake pipe and filter assembly.
7. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.
8. Lower car and add five quarts of transmission fluid through filler tube when replacing intake pipe and filter assembly. When draining bottom pan only, add four quarts of transmission fluid.
9. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

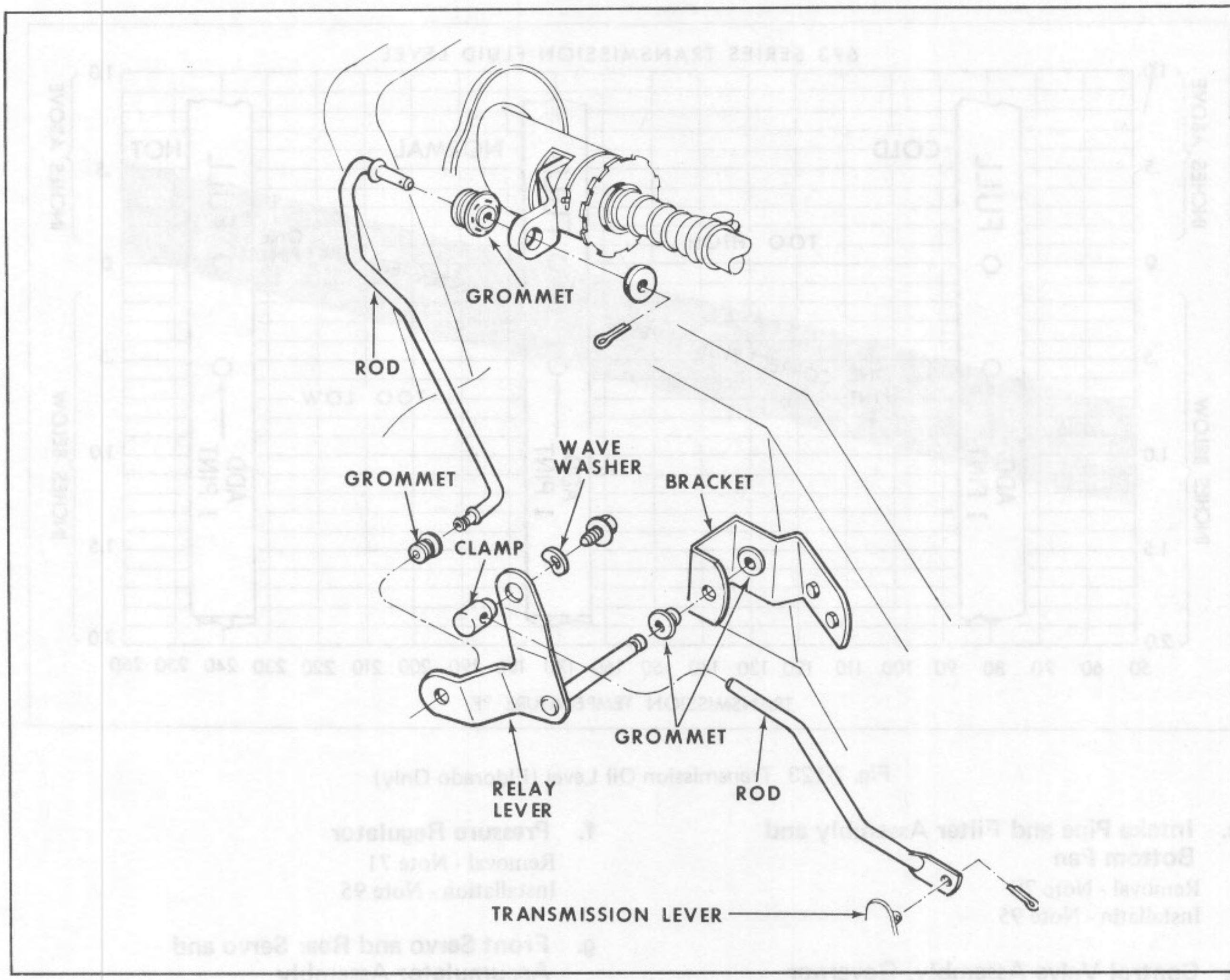


Fig. 7-122 Transmission Linkage

10. Reduce engine speed to slow idle and check fluid level. Add fluid to bring to proper level, Fig. 7-123.

d. Adding Fluid to Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 13 quarts, but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 9 quarts of transmission fluid through filler tube.
2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
3. Reduce engine speed to slow idle.
4. Check fluid level and add additional fluid to bring to proper level, Fig. 7-123.

e. Sprocket Housing Cover Removal

If the sprocket housing cover is removed, add transmission oil as described in part b of this note.

63. Towing Instructions

Refer to the General Motors Passenger Car and Light Truck Towing Instructions Manual.

64. Units That Can Be Removed With Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

While the detailed procedure for removing each of the units is not outlined separately, the procedures covered under the transmission disassembly and assembly will apply.

a. Governor Assembly

Removal - Note 68
Disassembly - Note 96
Installation - Note 96

b. Speedometer Driven Gear Assembly

Removal - Note 69
Installation - Note 96

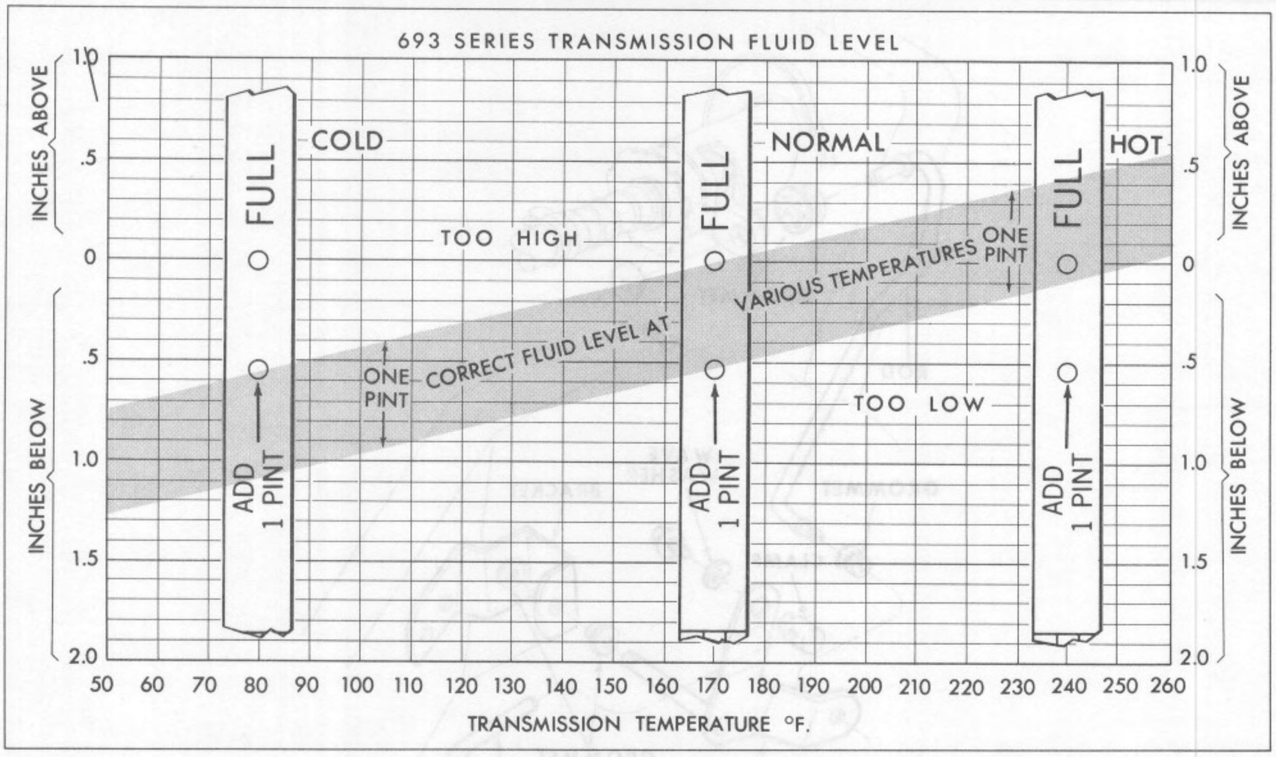


Fig. 7-123 Transmission Oil Level (Eldorado Only)

c. Intake Pipe and Filter Assembly and Bottom Pan
Removal - Note 70
Installatin - Note 95

d. Control Valve Assembly, Governor Pipes, Detent Spring and Roller Assembly, and Check Balls
Removal - Note 72
Disassembly - Note 94
Installation - Note 94

e Vacuum Modulator and Valve
Removal - Note 67
Installation - Note 95

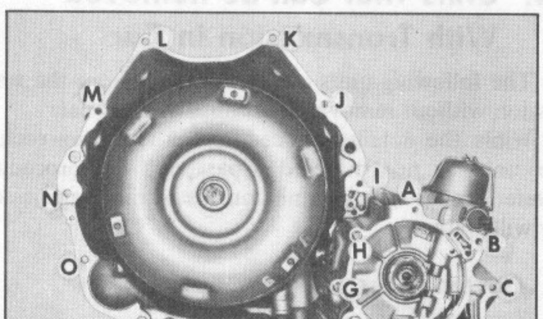


Fig. 7-124 Transmission Attaching Bolts

f. Pressure Regulator
Removal - Note 71
Installation - Note 95

g. Front Servo and Rear Servo and Accumulator Assembly
Removal - Note 73
Disassembly - Note 93
Installation - Note 93

h. Detent Lever, Manual Shaft, and Parking Linkage
Removal - Note 75
Installation - Note 93

65. Transmission Removal and Installation (Fig. 7-124)

a. Removal

1. Disconnect negative battery cable.
2. Remove transmission dipstick.
3. Loosen nut securing filler tube bracket to exhaust manifold and remove filler tube, catching fluid in clean pan.
4. Remove and discard O-ring on filler tube.
5. Remove bolts at locations "A", "B" and "C", securing final drive case to transmission, Fig. 7-124.
6. Disconnect detent solenoid connector at transmission case.
7. Disconnect speedometer cable from governor assembly.
8. Disconnect oil cooler pipes at transmission using an open end wrench to hold fitting and a tubing wrench

or a crowfoot adapter to remove tube nut. Cap pipes and plug connector holes in transmission. Position oil cooler pipes out of way.

9. Remove nut at location "H", securing final drive case to transmission, Fig. 7-124.

10. Remove bolts at locations "I", "J", "K" and "L", securing transmission to engine, Fig. 7-124.

11. Remove ground strap from cowl.

12. Loosen upper left bolt securing converter cover plate to transmission by using a 7/16 inch universal socket and extension. Bolt can be seen from engine compartment.

13. Disconnect starter harness from engine harness.

14. Raise car.

15. Remove bolt at location "O", Fig. 7-124, securing starter motor to transmission case and remove ground strap from bolt.

16. Holding starter, remove bolt at location "P", Fig. 7-124 and remove starter, wiring clip and harness.

17. Disconnect transmission downshift switch connector at transmission.

18. Remove vacuum pipe from vacuum modulator.

19. Remove three remaining bolts securing converter cover plate to transmission and remove cover plate.

20. Position transmission jack, equipped with front wheel drive transmission adapter plate, to transmission at starter motor lower mounting hole, Fig. 7-126.

21. Secure transmission to transmission jack adapter plate with safety chain.

22. Remove three flywheel to converter attaching bolts.

CAUTION: This can be done by installing a 9/16-18 screw, and washer into end of crankshaft at harmonic balancer, after removing cork plug, and rotating converter and flywheel until screws are accessible for removal. Do not pry on flywheel ring gear to rotate flywheel and converter, as flywheel may be damaged.

23. Remove cotter pin securing relay rod to manual yoke on left side of transmission and separate relay rod from yoke.

24. Remove bolts at location "M" and "N", Fig. 7-155, securing transmission to engine.

25. Remove bolts at location "D", "E", "F" and nut location "G", securing final drive to transmission, Fig. 7-124.

(NOTE: Position drain pan under point where transmission and final drive meet as transmission fluid will be lost when transmission and final drive are separated.)

26. Loosen final drive through bolt at upper mount.

27. Through access holes in bottom of transmission support bar, remove two bolts securing rear motor mount to transmission support bar.

28. Remove motor mount from bracket and remove both from chassis.

29. Use small pry bar to separate transmission from engine and final drive.

CAUTION: Select pry points with care to avoid damaging any components.

30. After initial separation has been made, allow transmission oil to drain at final drive junction.

31. Pry and hold final drive forward, move transmission rearward to disengage transmission case from dowels on engine and to disengage final drive from studs on transmission case.

CAUTION: Final drive unit is limited in its forward travel.

32. Slowly lower transmission, making certain top of transmission case clears flywheel ring gear.

33. Pry final drive forward and input end downward pivoting around through bolt to provide clearance for final drive input shaft.

34. When converter is approximately half-way exposed from flywheel, install Converter Holding Clamp, J-21366, using a 5/16-18 nut to hold clamp screw to transmission case at location "N", Fig. 7-124.

CAUTION: Converter Holding Clamp, J-21366, must be used to avoid the possibility of the converter becoming disengaged when the transmission is removed.

35. Remove and discard final drive gasket and clean mounting surface of final drive.

b. Installation

1. Position transmission on jack equipped with adapter plate, under car.

2. Install new gasket on final drive, after first soaking gasket with transmission fluid.

3. Remove Converter Holding Clamp, J-21366, from transmission.

4. Raise transmission in place while prying final drive forward and input shaft downward.

5. Holding final drive with pry bar, continue raising transmission, making certain top of transmission case clears splined input shaft of final drive, and position to engine.

6. Position transmission to engine assembly and final drive by aligning the following points in order listed:

a. Studs on transmission case to mounting holes in final drive.

b. Guide holes in transmission case to dowels on engine crankcase.

c. Internal flange on final drive to transmission.

CAUTION: As engagement of splined final drive input shaft to transmission is hidden, extreme care must be taken to avoid damaging transmission or final drive assembly.

d. To facilitate engagement of final drive splines, rotate one front wheel while helper holds other.

(NOTE: When alignment is complete and proper, gap between final drive case and transmission should not exceed 1/4 inch.)

7. Loosely install bolts at locations "D" and "F" attaching transmission to final drive and bolt at location "N" attaching transmission to engine, Fig. 7-124. Alternately tighten bolts to avoid cocking transmission. Do not torque bolts at this time.

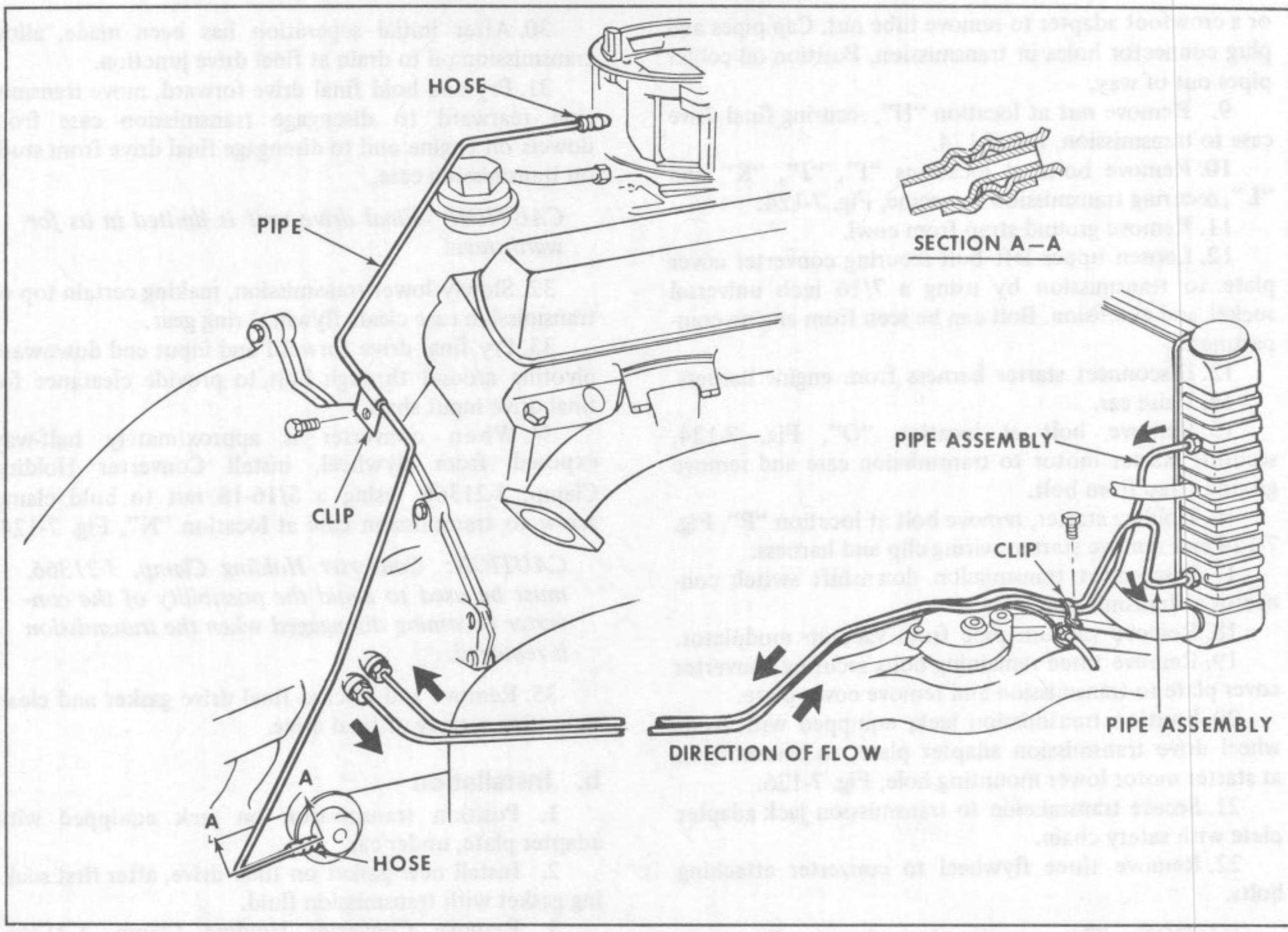


Fig. 7-125 Transmission External Components

8. Position rear engine mount and bracket on top of transmission support bar against underbody. Secure mount to bracket with three screws. Loosely install two screws holding transmission mount to support bar.

9. Perform following work in engine compartment:

a. Loosely install bolts at locations "M" and "J" attaching transmission to engine crankcase, Fig. 7-124. Do not torque bolts at this time.

b. Position rear engine mount bracket to engine and install bolts at locations "K" and "L", Fig. 7-124.

10. Remove safety chain, remove bolt securing jack adapter plate to transmission case and remove transmission jack.

11. Torque the following bolts as specified.

a. Rear engine mount to transmission support bar - 55 foot-pounds.

b. Rear engine mount to bracket - 25 foot-pounds.

c. Transmission to engine (location "M" and "N", Fig. 7-124) - 30 foot-pounds.

CAUTION: The procedure for attaching the converter to the flywheel as described in steps 12 through 14 must be strictly followed. Any deviation from this procedure will result in improper installation and damage to flywheel and transmission.

12. Rotate converter until two of the three weld nuts on converter line up with two of the three holes in flywheel. Position converter so that weld nuts are flush with flywheel, making certain converter is not cocked and that pilot in center of converter is properly seated in crankshaft.

13. Install two flywheel to converter attaching bolts through accessible holes in flywheel and tighten finger tight.

14. Rotate flywheel and converter by rotating screw previously installed in forward end of crankshaft, until

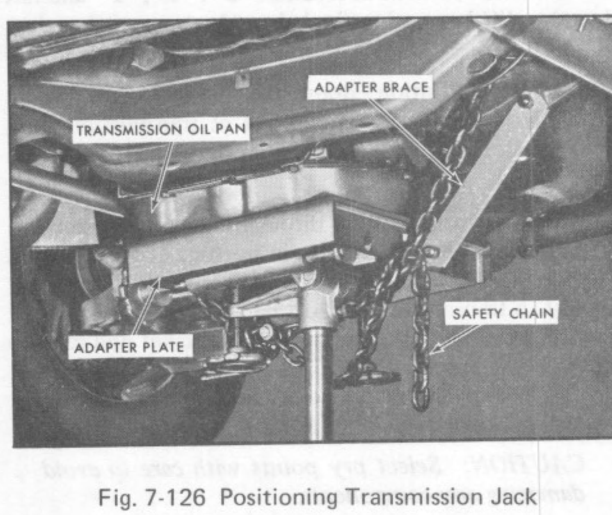


Fig. 7-126 Positioning Transmission Jack

third hole is accessible. Install third bolt and tighten all bolts to 30 foot-pounds. Remove screw from crankshaft and install cork plug.

15. Install vacuum hose on vacuum modulator assembly and connect transmission downshift switch wire at connector.

16. Position converter cover plate to transmission case and install two lower and one upper right bolts securing cover plate to transmission, tightening to 5 foot-pounds.

17. Position starter to transmission case and install bolt and starter motor wiring clip at location "P", Fig. 7-124.

18. Position ground strap to transmission and install bolt securing ground strap and starter motor to transmission at location "O". Tighten bolts at locations "O" and "P" to 25 foot-pounds, Fig. 7-124.

19. Install bolts at locations "C" and "E" and nut at location "G", securing transmission to final drive, Fig. 7-124.

20. Torque bolts at locations "C" through "F" to 35 foot-pounds, Fig. 7-124.

21. Position relay rod to manual lever and secure with cotter pin.

22. Check operation of manual linkage and adjust, if necessary, as described in Note 60.

23. Lower car.

24. Connect starter harness to engine harness.

25. Install bolts at location "A" and "B" and nut at location "H", securing transmission to final drive, Fig. 7-124. Tighten bolts to 35 foot-pounds.

26. Install upper left bolt securing converter cover plate to transmission using 7/16 inch universal socket and extension.

27. Torque bolts at locations "I", "J", "K" and "L" to 25 foot-pounds, Fig. 7-124. Vacuum modulator pipe bracket is also installed at location "L".

28. Tighten cooler pipe connectors at case to 20 foot-pounds. Clean ends of cooler pipes with solvent, reposition cooler pipes and connect pipes to transmission using an open end wrench to hold fitting and a tubing wrench or crowfoot adapter, Fig. 7-125. Tighten to 20 foot-pounds.

29. Install speedometer cable and detent solenoid connector.

30. Install new O-ring on transmission filler tube and install filler tube through hole in final drive case.

31. Position transmission filler tube bracket to exhaust manifold and install retaining nut.

32. Install body ground strap to cowl.

33. Connect negative battery cable.

34. Fill transmission with fluid as required, see Note 62.

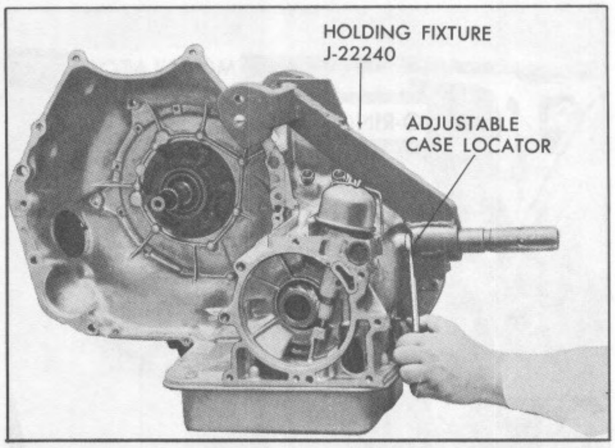


Fig. 7-127 Attaching Transmission Holding Fixture

66. Installing Transmission on Holding Fixture

1. With transmission on portable jack, remove Converter Holding Clamp, J-21366, and then remove converter assembly from transmission by pulling converter straight out of housing.

CAUTION: Converter with oil weighs approximately 50 pounds. Be careful not to drop or damage converter when removing it.

If transmission is to be overhauled, place converter on opposite end of workbench from transmission Holding Fixture Base.

2. Position Transmission Holding Fixture, J-22240, to transmission, Fig. 7-127.

3. Attach Holding Fixture, J-22240, to transmission using a 3/8-16 x 2-1/4 inch bolt and nut at location "J". Use special screw provided with Holding Fixture to attach Holding Fixture to rear side of transmission case.

4. Tighten adjustable case locator pivot bolt to boss on side of transmission case.

CAUTION: Do not over torque adjustable case locator nut.

5. Install Transmission Holding Fixture, J-22240, and transmission into Holding Fixture Base, J-3289-01, then install lock pin in base.

6. Remove transmission jack from transmission.

7. Provide a container to catch any oil that may drain from transmission.

MAJOR TRANSMISSION COMPONENTS–REMOVAL

67. Remove Vacuum Modulator and Valve

(NOTE: Unit may be removed without removing transmission or bottom pan, after removing vacuum hose.)

1. Remove vacuum modulator attaching screw and retainer from transmission case.

2. Remove modulator assembly and O-ring from transmission case. Remove and discard O-ring from vacuum modulator, Fig. 7-128.

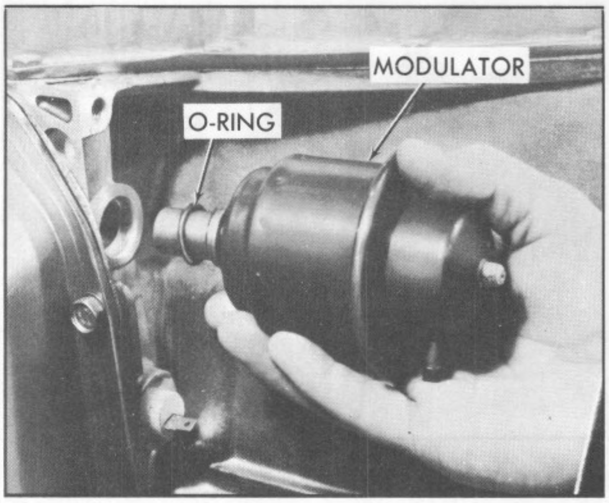


Fig. 7-128 Removing Vacuum Modulator

3. Remove modulator valve from transmission case, Fig. 7-129.

(NOTE: Modulator bushing is a tight fit in transmission case and should not be removed forcibly unless it is damaged, scored, or otherwise deformed.)

68. Remove Governor Assembly

(NOTE: Unit may be removed without removing transmission from car.)

1. Force top of spring clip downward, releasing governor assembly.
2. Remove governor assembly from case, and remove square-cut O-ring from governor assembly and discard O-ring, Fig. 7-130.

(NOTE: The governor assembly, including the driven gear, is replaceable. See Note 96.)

69. Remove Speedometer Driven Gear

(NOTE: Unit may be removed without removing transmission from car or without removing governor assembly.)

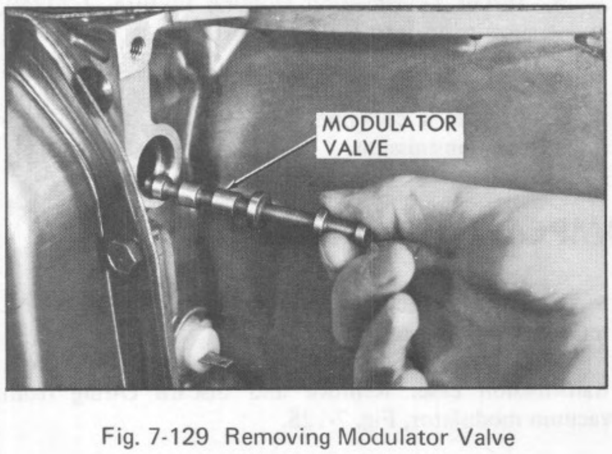


Fig. 7-129 Removing Modulator Valve

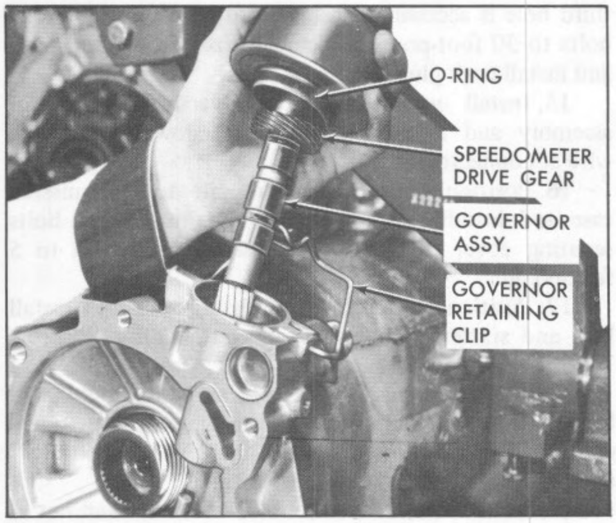


Fig. 7-130 Removing Governor Assembly

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove sleeve and speedometer driven gear.
2. Remove and discard O-ring from speedometer driven gear assembly.

70. Remove Intake Pipe and Filter Assembly and Bottom Pan

(NOTE: Units may be removed with transmission in car. In cases of transmission malfunction, intake pipe and filter must be replaced.)

1. Rotate transmission and Holding Fixture in Holding Fixture Base so that transmission bottom pan is up. Position container to catch any fluid which may drain from transmission.
2. Remove 13 bottom pan attaching screws.
3. Remove bottom pan and gasket, discarding gasket.
4. Lift out intake pipe and filter assembly, Fig. 7-131.

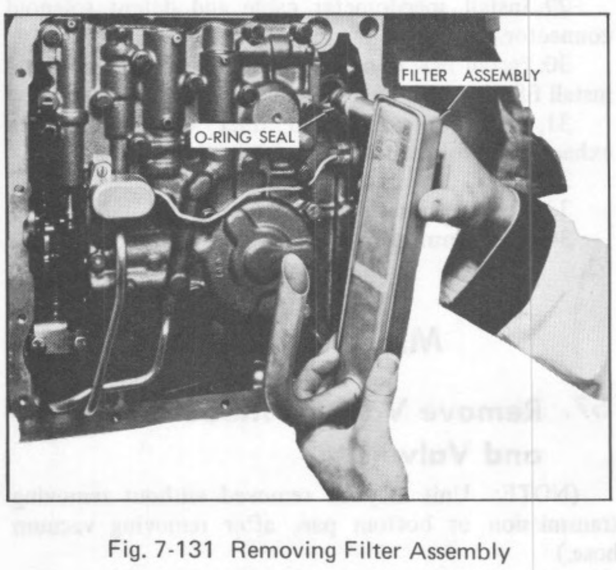


Fig. 7-131 Removing Filter Assembly

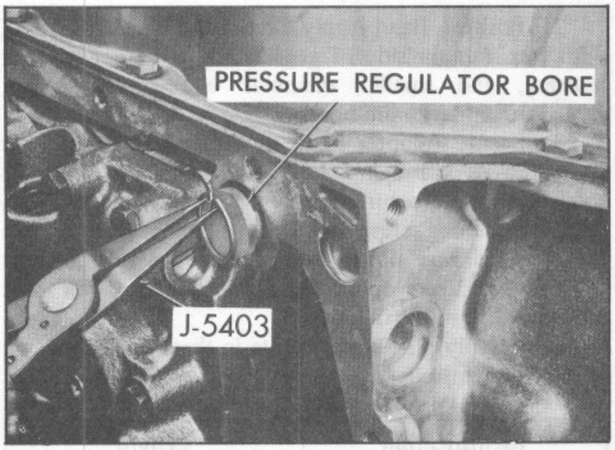


Fig. 7-132 Removing Pressure Regulator Valve

5. Remove and discard intake pipe O-ring, Fig. 7-131.

71. Remove Pressure Regulator Valve

(NOTE: Unit may be removed with transmission in car after removing bottom pan.)

1. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-132.

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED.

2. Remove regulator boost valve bushing and valve.
3. Remove pressure regulator spring.
4. Remove regulator valve, spring retainer, and spacer or spacers if present.

72. Remove Control Valve Assembly, Governor Pipes, Detent Spring, and Roller Assembly, and Check Balls

(NOTE: Units may be removed with transmission in car, after removing bottom pan.)

1. Remove attaching screw and remove detent roller and spring assembly.
2. Disconnect detent wire from case connector.
3. Remove governor feed pipe from transmission case and valve body by lifting straight out, Fig. 7-133.
4. Remov nineteen remaining control valve assembly attaching screws. Do not remove detent solenoid attaching screws at this time.

(NOTE: If the transmission is in the vehicle, the front servo piston assembly may drop down as the control valve assembly and governor pipe are removed.)

5. Remove control valve assembly with remaining governor pipe attached, Fig. 7-134.

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly.

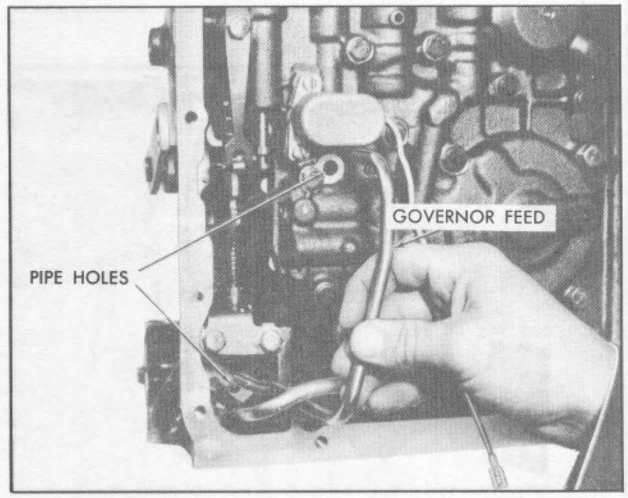


Fig. 7-133 Removing Governor Feed Pipes

6. Remove remaining governor pipe from valve body.
7. Remove control valve assembly to spacer gasket.
8. Remove control valve spacer and spacer-to-transmission case gasket, Fig. 7-135.

CAUTION: If control valve assembly is removed in car, seven check balls will come down with spacer.

9. Remove seven check balls from cored passages in transmission case.

(NOTE: The eighth check ball is held in by a retainer and should not be removed unless replacement is required.)

73. Remove Front Servo Piston and Rear Servo Piston

(NOTE: Units may be removed with transmission in car after removing bottom pan and control valve assembly.)

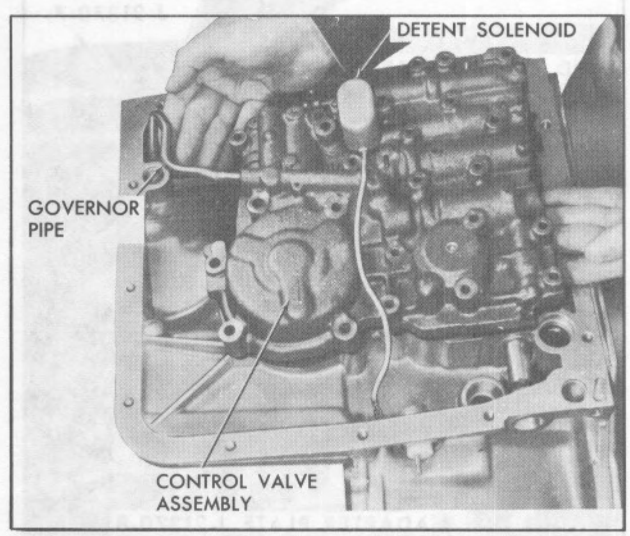


Fig. 7-134 Removing Control Valve Assembly

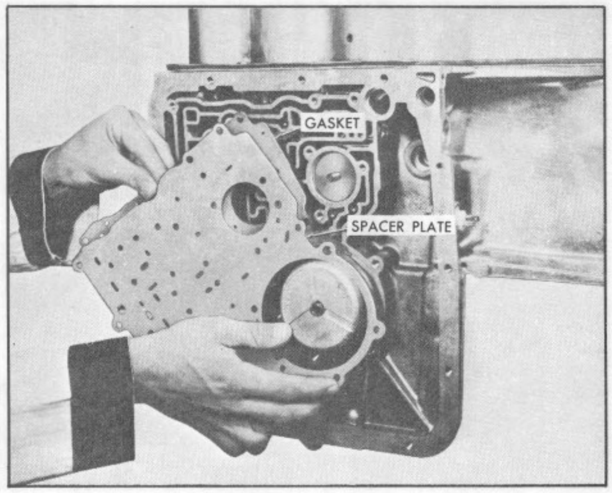


Fig. 7-135 Removing Control Valve Spacer

1. Lift front servo piston retainer ring, pin, spring retainer and spring out of transmission case.
2. Remove rear servo assembly from transmission case.
3. Remove rear servo accumulator spring.
4. Make band apply pin selection check to determine proper size pin to use at time rear servo is assembled. Proceed as described in Note 74.

74. Band Apply Pin Selection Check (Fig. 7-136)

(NOTE: Check may be made with transmission in car. Remove bottom pan, control valve assembly, and rear servo.)

1. Position Adapter Plate, J-21370-8, on transmission case over rear servo bore, and, using screws provided with Adapter Plate, attach Band Apply Pin Selector Gage, J-21370 to Adapter Plate.

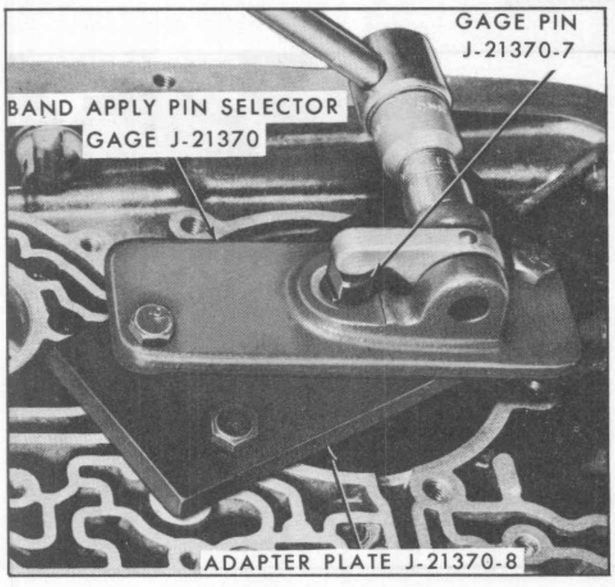


Fig. 7-136 Band Apply Pin Selection Check

2. Position Band Apply Pin Selector Gage, J-21370, with hex nut on side of gage facing toward converter housing, and smaller diameter end of Gage Pin, J-21370-7, in servo pin bore.
3. Secure Adapter Plate to transmission case with two 5/16-18 x 1 inch screws, tightening screws to 18 foot-pounds and secure Selector Gage to Adapter Plate, tighten attaching screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up and down in both tool and servo pin bore. Stepped side of pin must face rear of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

Identification	Length
Three Rings	Long
Two Rings	Medium
One Ring	Short

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

4. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is even with or below lower step on gage pin, short size pin (one ring) is required.

5. If new pin is required, make note of pin size required, and remove gage from transmission case.

75. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-137)

(NOTE: Units may be removed with transmission in car after removing bottom pan and detent roller and spring assembly from control valve assembly.)

1. Remove pin securing manual shaft to case by pulling straight out.
2. Loosen locknut securing detent lever to manual shaft.
3. Pry or work detent lever loose from ground flats on manual shaft.
4. Remove manual shaft from case bore and remove and discard O-ring seal from manual shaft.

(NOTE: Be careful not to drop jam nut inside of case.)

5. Remove detent lever and parking brake actuator assembly from case and remove actuator assembly from detent lever.
6. Remove parking brake bracket attaching screws and remove bracket.

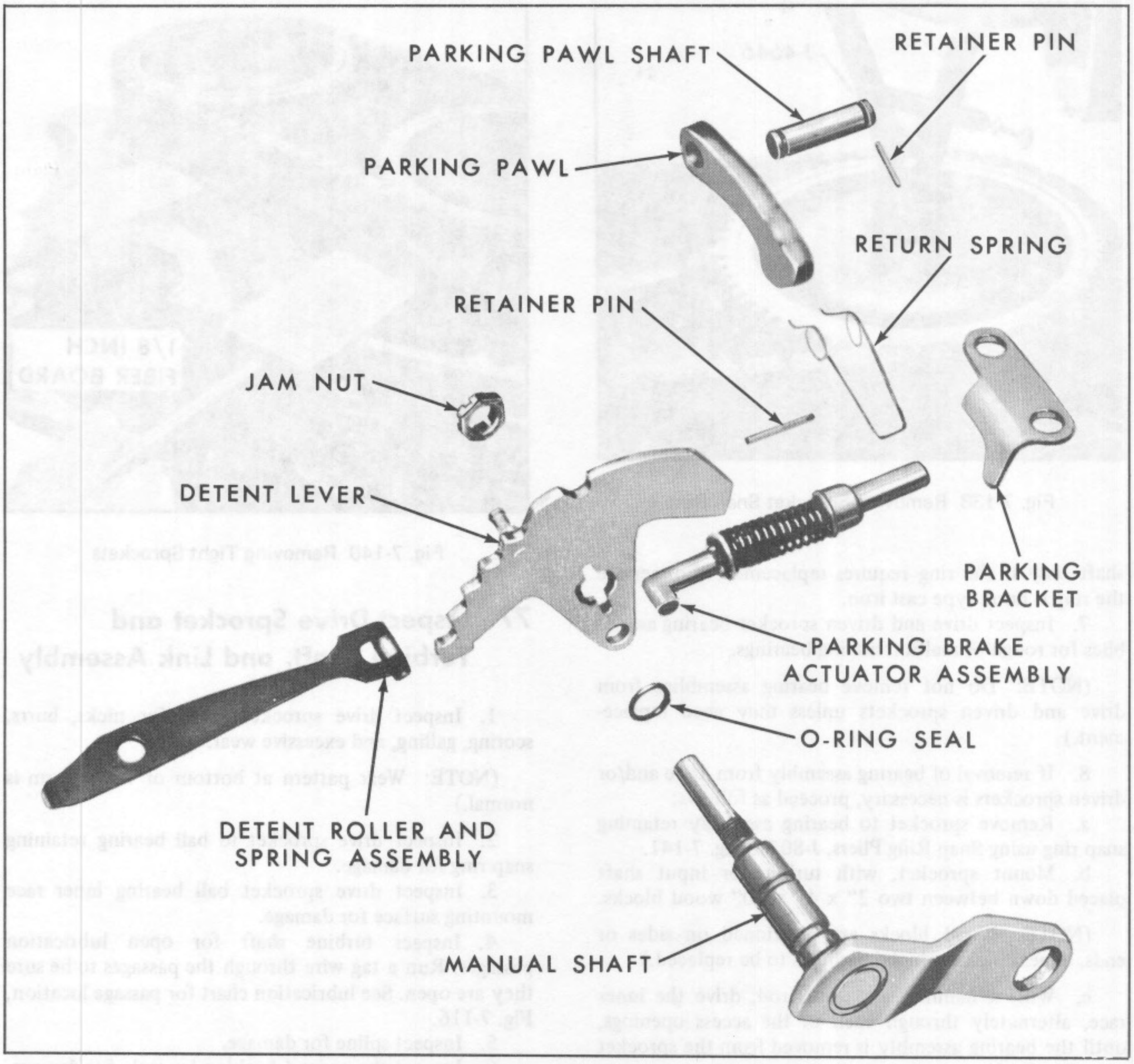


Fig. 7-137 Manual and Parking Linkage—Exploded View

7. Remove retainer pin securing parking pawl shaft to transmission case by pulling straight out.

8. Remove parking pawl shaft, parking pawl and return spring.

76. Remove Sprocket Cover, Link Assembly, Drive and Driven Sprockets

1. Rotate transmission in holding fixture base so that sprocket cover is up and remove eighteen cover attaching screws.

2. Remove cover and gasket and discard gasket.

3. Install Snap Ring Pliers, J-4646, into sprocket bearing retaining snap rings located under the drive and driven sprockets, and remove snap rings from retaining grooves on support housing, Fig. 7-138.

(NOTE: Leave snap rings in a loose position between sprockets and bearing assemblies.)

4. Remove drive and driven sprockets, link assembly, bearings, and shafts simultaneously by alternately pulling upwards on the drive and driven sprockets until the bearings are out of the drive and driven support housings, Fig. 7-139.

(NOTE: If the sprockets are difficult to remove, place a small piece of fiberboard between the sprocket and sprocket support cover. Using a 1/2 x 9 inch pry bar, alternately pry upward under each sprocket on sprocket support cover. Do not pry on the guide links or the aluminum case. Pry only on the sprockets, Fig. 7-140.)

5. Remove link assembly from drive and driven sprockets.

6. Remove the teflon oil seal ring from turbine

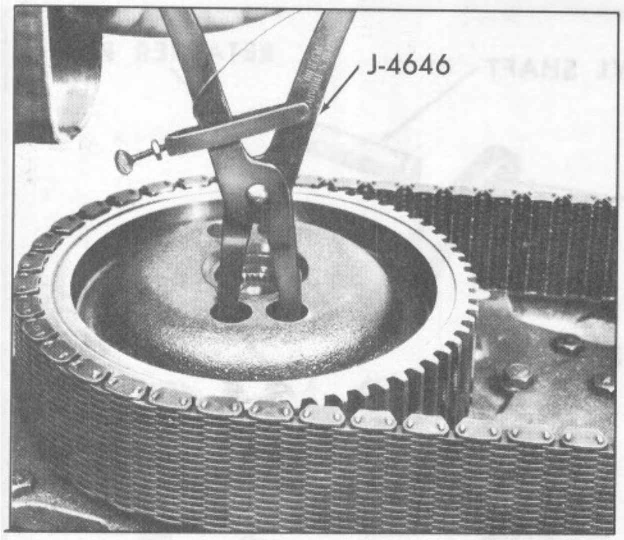


Fig. 7-138 Removing Sprocket Snap Ring

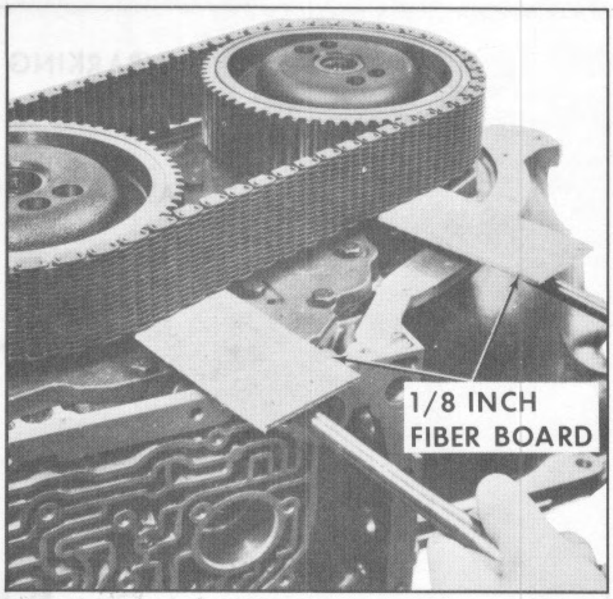


Fig. 7-140 Removing Tight Sprockets

shaft only if the ring requires replacement. For service the ring is hook type cast iron.

7. Inspect drive and driven sprocket bearing assemblies for rough or malfunctioning bearings.

(NOTE: Do not remove bearing assemblies from drive and driven sprockets unless they need replacement.)

8. If removal of bearing assembly from drive and/or driven sprockets is necessary, proceed as follows:

a. Remove sprocket to bearing assembly retaining snap ring using Snap Ring Pliers, J-8059, Fig. 7-141.

b. Mount sprocket, with turbine or input shaft placed down between two 2" x 4" x 10" wood blocks.

(NOTE: Wood blocks are positioned on sides or ends, depending on which bearing is to be replaced.)

c. With a hammer and brass rod, drive the inner race, alternately through each of the access openings, until the bearing assembly is removed from the sprocket hub, Fig. 7-142.

77. Inspect Drive Sprocket and Turbine Shaft, and Link Assembly

1. Inspect drive sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

(NOTE: Wear pattern at bottom of tooth form is normal.)

2. Inspect drive sprocket to ball bearing retaining snap ring for damage.

3. Inspect drive sprocket ball bearing inner race mounting surface for damage.

4. Inspect turbine shaft for open lubrication passages. Run a tag wire through the passages to be sure they are open. See lubrication chart for passage location, Fig. 7-116.

5. Inspect spline for damage.

6. Inspect the ground bushing journals for damage.

7. Inspect the oil seal groove for damage or excessive wear.

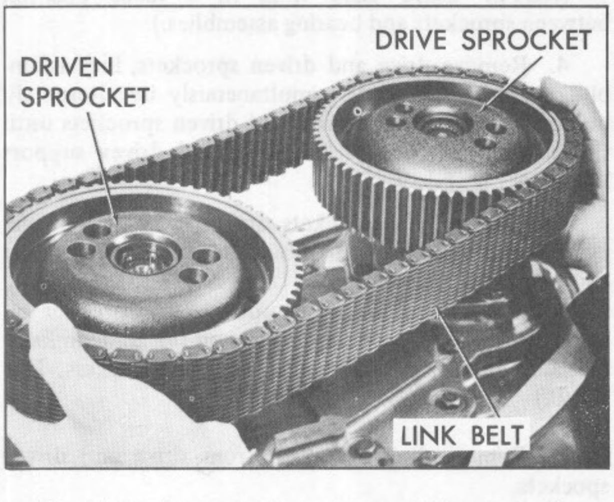


Fig. 7-139 Removing Sprocket and Link Assembly

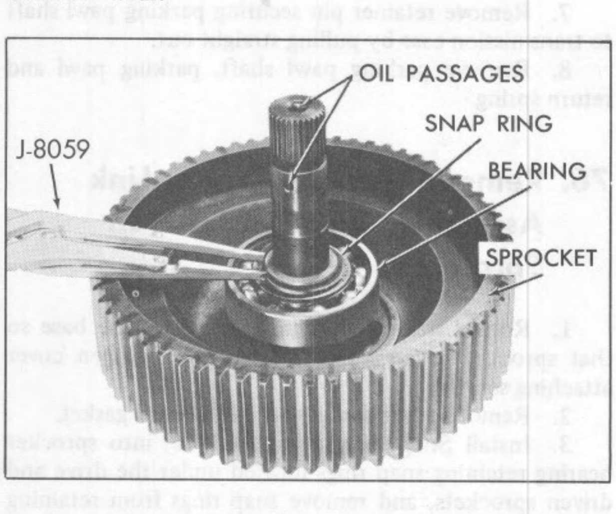


Fig. 7-141 Removing Sprocket Bearing Snap Ring

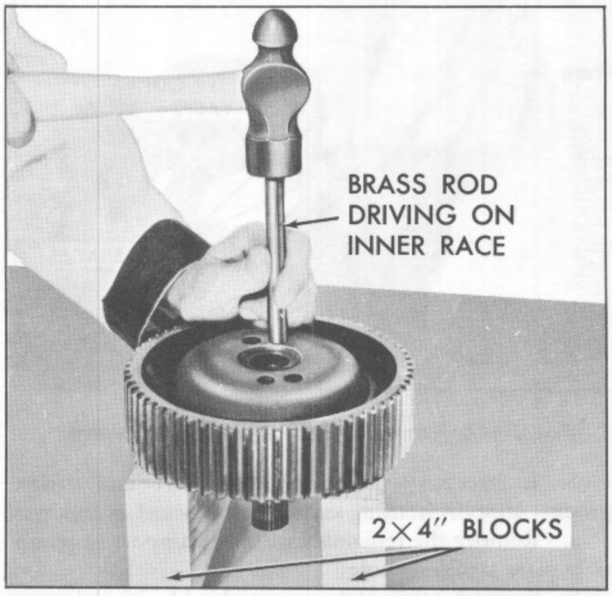


Fig. 7-142 Removing Sprocket Bearing

8. Inspect turbine shaft oil seal ring for damage. Do not remove unless replacement of ring is required for service. The ring is hook type cast iron.
9. Inspect the turbine shaft for cracks or distortion.
10. Inspect the link assembly for damage or loose links.

(NOTE: Check the guide links. Guide links are the wide outside links on each side of the link assembly.)

78. Inspect Driven Sprocket and Input Shaft

1. Inspect driven sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

(NOTE: Wear pattern at bottom of tooth form is normal.)

2. Inspect sprocket to ball bearing retaining snap ring for damage.
3. Inspect ball bearing inner race mounting surface for damage.
4. Inspect input shaft for open lubrication holes. Run a tag wire through the holes to be sure they are open. See Fig. 7-116 for location of holes.
5. Inspect spline for damage.
6. Inspect ground bushing journal for damage.

79. Install Sprocket Bearings

1. Turn sprocket so that turbine or input shaft is pointing upward.
2. Install new sprocket bearing as follows:
a. Install support snap ring, letter side down onto shaft.
b. Assemble bearing assembly on turbine or input shaft.
c. Using a piece of pipe, drive the bearing assembly onto the hub of the sprocket until it is resting on the bearing seat of the sprocket.

CAUTION: Use pipe that closely fits I.D. of bearing assembly but does not contact shaft.

d. Install sprocket to bearing assembly retaining snap ring into groove in sprocket hub.
3. If necessary install hook type oil seal ring on turbine shaft.

(NOTE: Turbine and/or input shaft may appear not to be pressed fully into the sprocket. Do not attempt pressing shaft further as a specific length dimension is held during initial assembly.)

80. Front Unit End Play Check

1. Install Front Unit End Play Checking Tool, J-22241, into driven sprocket housing so that the urethane on the tool can engage the splines in the forward clutch housing. Let the tool bottom on the mainshaft and then withdraw it approximately 1/8 inch and tighten nut on tool, Fig. 7-143.
2. Remove one bolt from the driven support housing, and install Slide Hammer Bolt, J-6125-1, into bolt hole in driven support housing.

(NOTE: Do not thread slide hammer bolt deep enough to interfere with forward clutch housing travel.)

3. Mount Dial Indicator, J-8001, on slide hammer bolt and index indicator to register with the Front Unit End Play Checking Tool, J-22241, Fig. 7-143 and push tool down to remove slack.
4. Push and hold output flange upward. Place a screw driver in case opening at parking pawl area and push upward on output carrier.
5. Place a screw driver between the metal lip of the end play tool and the driven sprocket housing and push upward on the metal lip of the end play tool and read

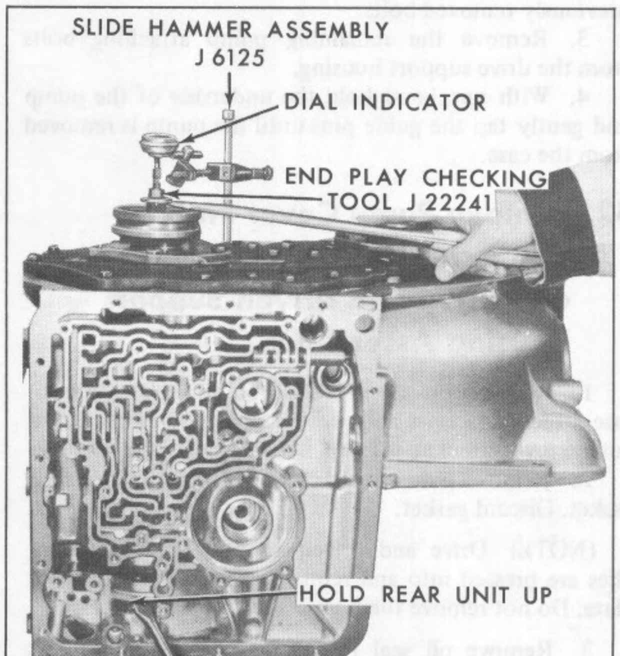


Fig. 7-143 Checking Front Unit End Play

the resulting end play, which should be between .003" and .024".

The selective washer controlling this end play is the thrust washer located between the driven support housing and the forward clutch housing. If more or less washer thickness is required to bring the end play within specifications, select the proper washer from the chart below:

THICKNESS	COLOR
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

(NOTE: An oil soaked washer may tend to discolor so that it will be necessary to measure the washer with a set of one inch micrometers to determine actual thickness.)

6. Remove end play tool from transmission and remove dial indicator and slide hammer bolt from transmission.

81. Remove Oil Pump

1. Remove two opposite pump attaching bolts from the drive support housing.
2. Install two 5/16-18 x 4" guide pins in holes from previously removed bolts.
3. Remove the remaining pump attaching bolts from the drive support housing.
4. With one hand hold the underside of the pump and gently tap the guide pins until the pump is removed from the case.

82. Remove Pump Cover Plate, Converter Out Check Valve and Drive and Driven Support Housing Assemblies

1. Remove the twenty-three pump cover plate-to-case attaching screws and remove pump cover plate. Do not remove sprocket support housing bolts at this time.
2. Remove pump cover plate and plate-to-case face gasket. Discard gasket.

(NOTE: Drive and driven support housing assemblies are pressed into and removed with the pump cover plate. Do not remove them unless it is necessary.)

3. Remove oil seal rings from the driven support housing if damaged.
4. Remove the front unit end play selective thrust washer from the hub of the driven support housing.

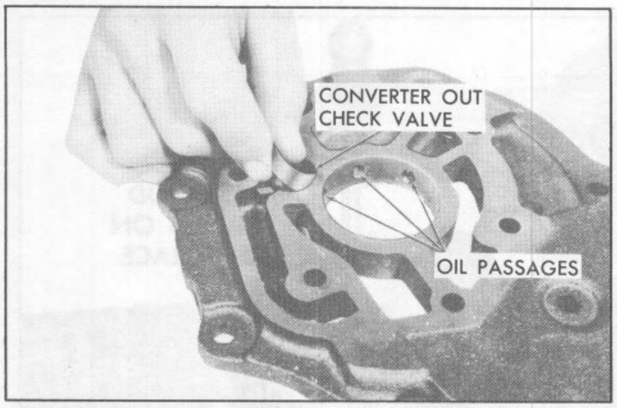


Fig. 7-144 Removing or Installing Check Valve

5. If necessary to remove the drive and driven sprocket support housing assemblies, proceed as follows:

a. Remove the remaining sprocket support to pump cover plate attaching bolts.

b. Support cover plate on wooden blocks and using a plastic mallet, vigorously strike the stator shaft of the drive sprocket support, Fig. 7-145, and the hub of the driven sprocket support, Fig. 7-146, until they are removed from their pump cover plate bores.

CAUTION: When driving the housings out of the pump cover plate avoid damaging or distorting the stator shaft or the ring grooves in the hub of the driven housing.

c. Remove and discard housing to pump cover plate gaskets.

d. Remove converter out check valve, Fig. 7-144.

e. Install converter out check valve.

f. Install drive sprocket support housing to pump cover plate gasket.

g. Install drive sprocket support housing into pump cover plate by using a plastic mallet to seat the housing. Use bolts for guides, Fig. 7-147.

h. Install driven sprocket support housing to pump cover plate gasket.

i. Install driven sprocket support housing to pump cover plate attaching bolts for gasket guides.

j. Install driven sprocket support housing into pump cover plate by using a plastic mallet to seat the housing.

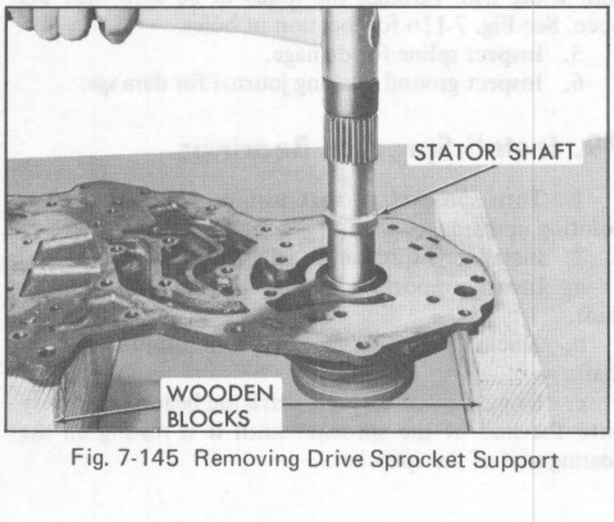


Fig. 7-145 Removing Drive Sprocket Support

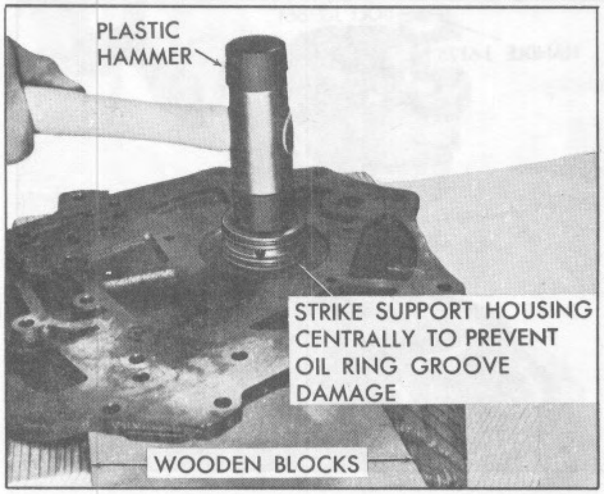


Fig. 7-146 Removing Driven Sprocket Support

k. Install all but one driven support housing to pump cover plate attaching bolts. Torque to 20 ft. lbs.

6. Install proper front unit end play selective thrust washer on the hub of the driven sprocket support housing. Use micrometer to determine the actual thickness of the thrust washer.

7. Install oil seal rings into the grooves in the hub of the driven sprocket support housing Fig. 7-148.

(NOTE: For service the ring is hook type cast iron.)

83. Remove Forward Clutch Assembly, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

1. Remove forward clutch assembly from transmission, Fig. 7-149, by installing Front End Play Checking Tool, J-22241, into forward clutch and lifting forward clutch straight out.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

3. Remove direct clutch and intermediate sprag assembly by lifting straight out. Sun gear shaft may come out with direct clutch assembly.

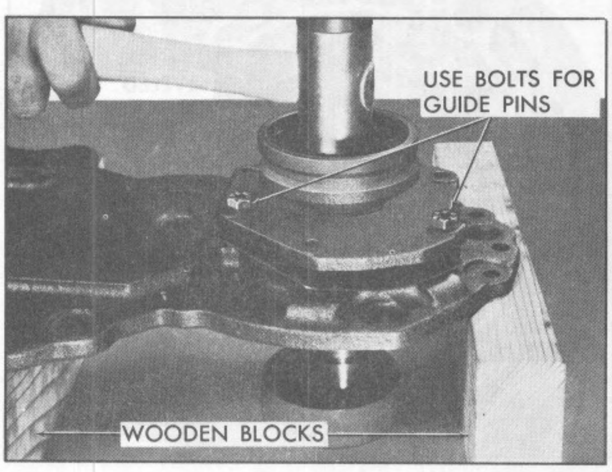


Fig. 7-147 Installing Driven Sprocket Support

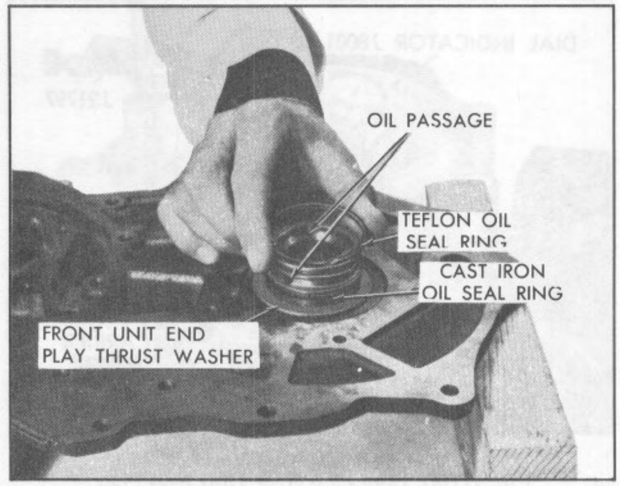


Fig. 7-148 Installing O-Rings on Sprocket Support

4. Remove sun gear shaft if not previously removed.

5. Remove front band assembly.

(NOTE: Check rear unit end play at this time. Proceed as described in Note 84.)

84. Rear Unit End Play Checking Procedure

1. Rotate transmission in holding fixture base so that forward end of transmission is up.

2. Install Speedometer Puller Bolt, J-21797, in one of the differential mounting bolt holes on end of transmission case.

3. Mount Dial Indicator, J-8001, on Bolt J-21797, and index indicator to register with flat surface on end of output flange, Fig. 7-150.

4. Set dial indicator to zero.

5. Using two screw drivers (180° apart) move output flange in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .007 inch-.019 inch.

(NOTE: Use of two screwdrivers avoids an angled condition and insures greater accuracy.)

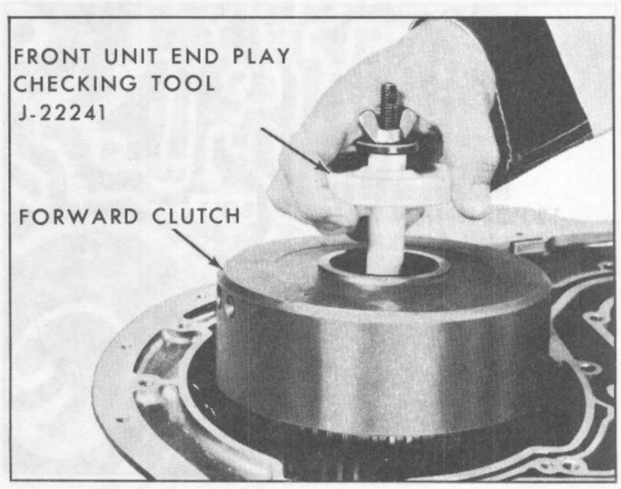


Fig. 7-149 Removing Forward Clutch

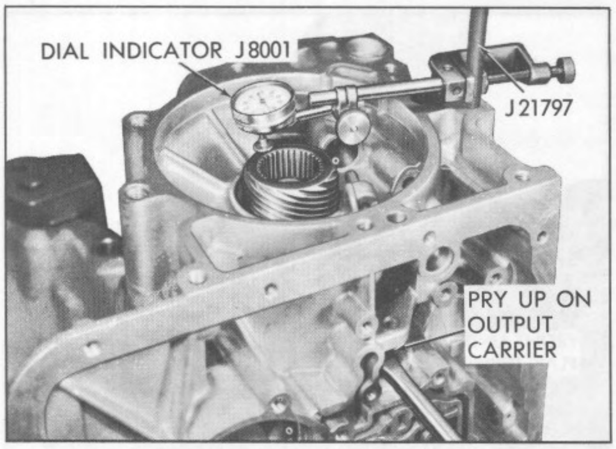


Fig. 7-150 Checking Rear Unit End Play

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches and/or numerals on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart. The tabs will show identification notches, numerals or both.

Thickness	Identification Notch and/or Numeral	
.074 - .078	None	1
.082 - .086	On Side of 1 Tab	2
.090 - .094	On Side of 2 Tabs	3
.098 - .102	On End of 1 Tab	4
.106 - .110	On End of 2 Tabs	5
.114 - .118	On End of 3 Tabs	6

6. Remove Dial Indicator, J-8001, and Bolt, J-21797, from transmission and rotate transmission so that rear end of transmission is up.

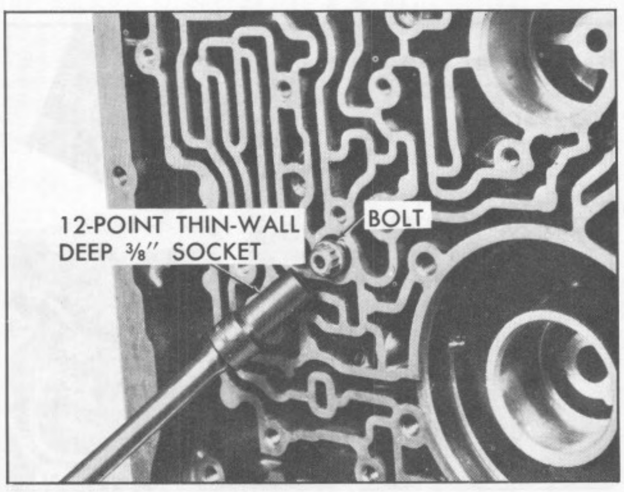


Fig. 7-151 Removing Center Support Bolt

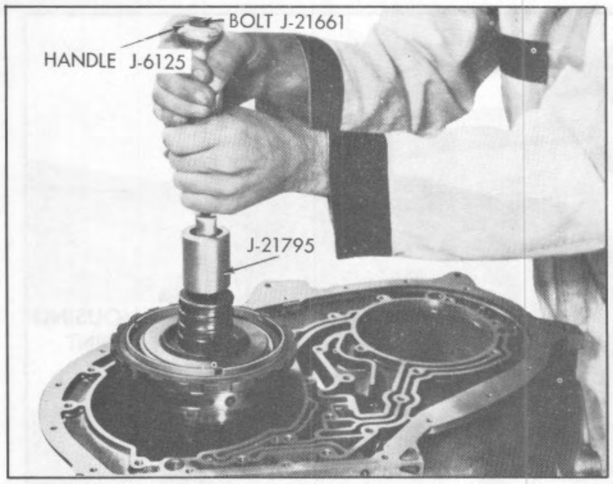


Fig. 7-152 Removing Gear Unit Assembly

85. Remove Remaining Components

1. Remove center support bolt from transmission case, Fig. 7-151, using a 3/8 inch 12-point thin wall deep socket.
2. Remove intermediate clutch backing plate to case snap ring.
3. Remove intermediate clutch backing plate, and three composition and three steel clutch plates.
4. Using a needle-nose pliers, or screwdriver, remove center support to case snap ring, Fig. 7-153.
5. Install Gear Assembly Remove and Installer Adapter, J-21795, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on tool to secure tool on shaft, Fig. 7-152.
6. Remove complete gear unit assembly from case, by lifting straight up.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal.

7. Remove output flange to case metal thrust washer from output flange or case.

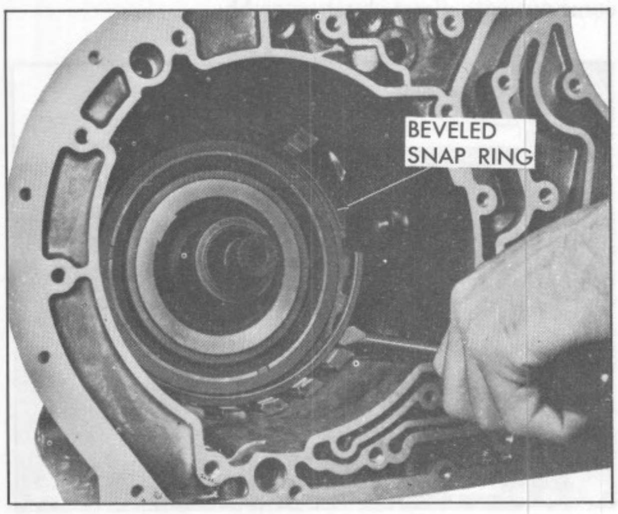


Fig. 7-153 Removing Snap Ring

8. Place gear unit assembly on bench with output flange down, Fig. 7-154. Remove Tool J-21795.

9. Remove support to case spacer (Fig. 7-176).

10. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.

11. Remove rear unit selective washer from transmission case.

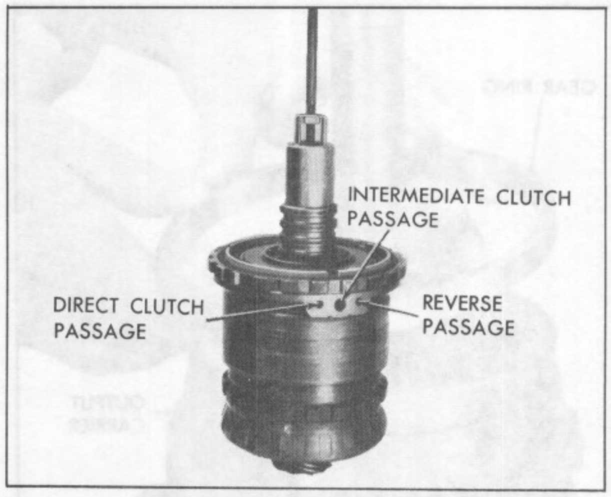


Fig. 7-154 Gear Unit Bench Position

INDIVIDUAL UNIT DISASSEMBLY, CLEANING, INSPECTION, ASSEMBLY AND INSTALLATION OF MAJOR COMPONENTS

86. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages, Fig. 7-117.
2. Check for good retention of band anchor pins.
3. Inspect all threaded holes for thread damage.
4. Inspect intermediate clutch driven plate lugs for damage or brinelling.
5. Inspect snap ring grooves for damage.
6. Inspect governor assembly bore for scratches or scoring.
7. Inspect governor pipes screen assemblies (located in governor pipe holes in case) for plugging or damage.
8. Inspect modulator valve bore for scoring or damage.
9. Inspect output flange bushing for wear, galling and open lubrication groove.

87. Center Support and Gear Unit

a. Disassembly

1. Remove center support assembly from reaction carrier by lifting center support straight up.

2. Remove center support to reaction carrier thrust washer.

(NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.)

3. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-155, and remove roller clutch assembly from reaction carrier.

4. Remove center support to sun gear races and thrust bearing from sun gear.

(NOTE: One of the races may have stuck to back of center support.)

5. Remove front internal gear ring from output carrier assembly, Fig. 7-156.

6. Remove sun gear from output carrier assembly.

7. Remove reaction carrier to output carrier plastic thrust washer from output carrier.

8. Invert gear unit and place in Rear Unit Holding Fixture, J-6116, with main shaft pointing downward.

9. Remove snap ring securing output flange to output carrier and remove output flange.

10. Remove thrust bearing and races from rear internal gear.

11. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.

12. Remove snap ring from end of main shaft and remove rear internal gear.

13. Remove output carrier from holding fixture.

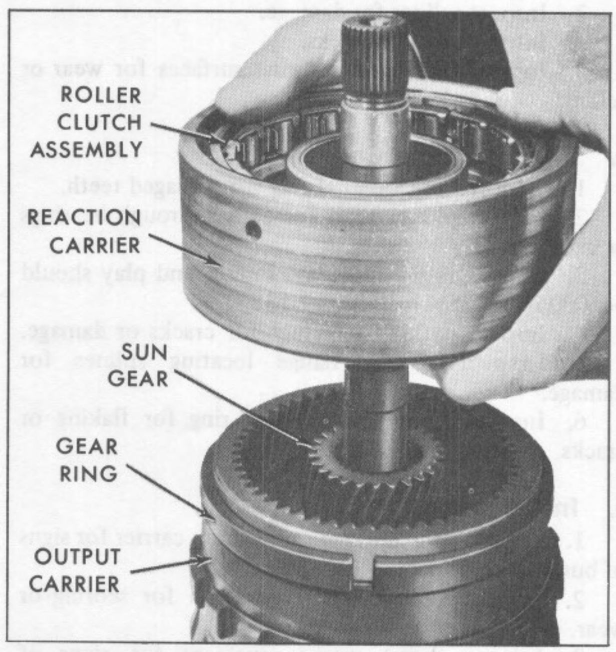


Fig. 7-155 Removing Reaction Carrier and Roller Clutch

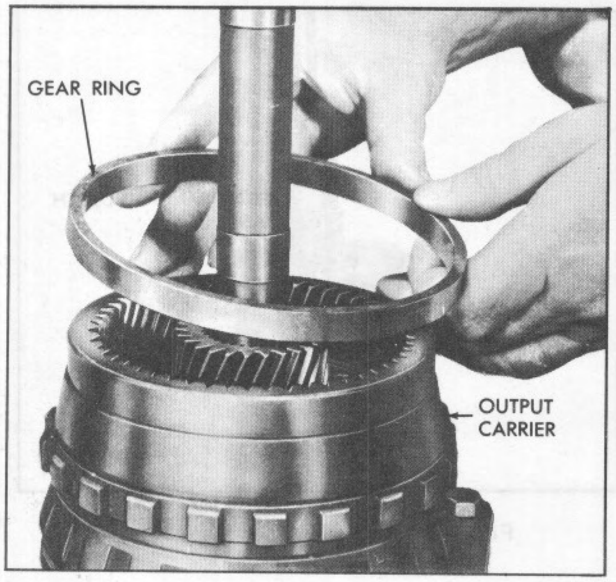


Fig. 7-156 Removing Front Internal Gear Ring

b. Inspect Output Flange

1. Inspect bearing and thrust washer surfaces for damage.
2. Inspect drive lugs for damage.
3. Inspect splines for damage.
4. Inspect lubrication passages.

c. Inspect Main Shaft

1. Inspect shaft for cracks or distortion.
2. Inspect splines for damage.
3. Inspect ground bushing journals for damage.
4. Inspect snap ring groove for damage.
5. Inspect lubrication passages.

d. Inspect Rear Internal Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Inspect gear for cracks.
4. Inspect bearing and thrust surfaces for wear or galling.

e. Inspect Output Carrier

1. Inspect front internal gear for damaged teeth.
2. Inspect pinion gears for damage, rough bearings or excessive tilt.
3. Check pinion end play. Pinion end play should be .009 inch - .024 inch, Fig. 7-157.
4. Inspect parking gear lugs for cracks or damage.
5. Inspect output flange locating splines for damage.
6. Inspect front internal gear ring for flaking or cracks.

f. Inspect Reaction Carrier

1. Inspect band surface on reaction carrier for signs of burning or scoring.
2. Inspect roller clutch outer cam for scoring or wear.
3. Inspect thrust washer surfaces for signs of scoring or wear.

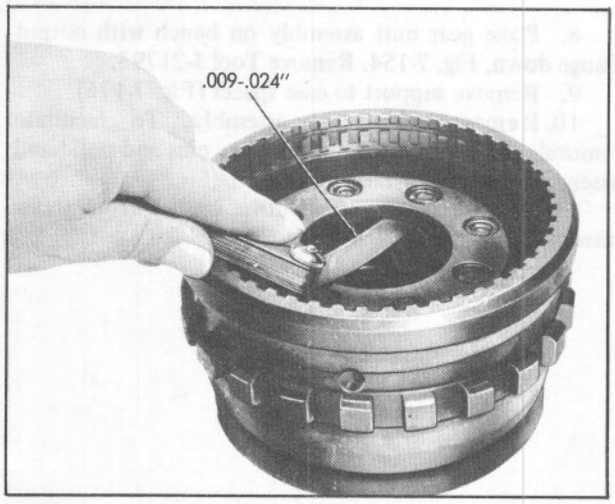


Fig. 7-157 Checking Pinion End Play

4. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.
5. Inspect pinion gears for damage, rough bearings or tilt.
6. Check pinion end play. Pinion end play should be .009 inch -.024 inch.

g. Pinion Gear Replacement - Reaction and Output Carrier Assemblies

1. Support carrier assembly on its FRONT face.
2. Using a 1/2 inch diameter drill remove the stake marks from the end of the pinion pin, or pins, to be replaced. This will reduce the porbability of cracking the carrier when the pinion pins are pressed out.

CAUTION: Do not allow drill to remove any stock from the carrier, as this will weaken the part, and could result in a cracked carrier.

3. Using a tapered punch, drive or press pinion pins out of carrier.
4. Remove pinion gears, thrust washers, and roller needle bearings.
5. Inspect pinion pocket thrust faces for burrs and remove if present.
6. Install eighteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.
7. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-158. Hold washers in place with petrolatum.
8. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.
9. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.
10. Using a punch in bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-159.

(NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.)

11. Repeat installation procedure for each pinion gear.

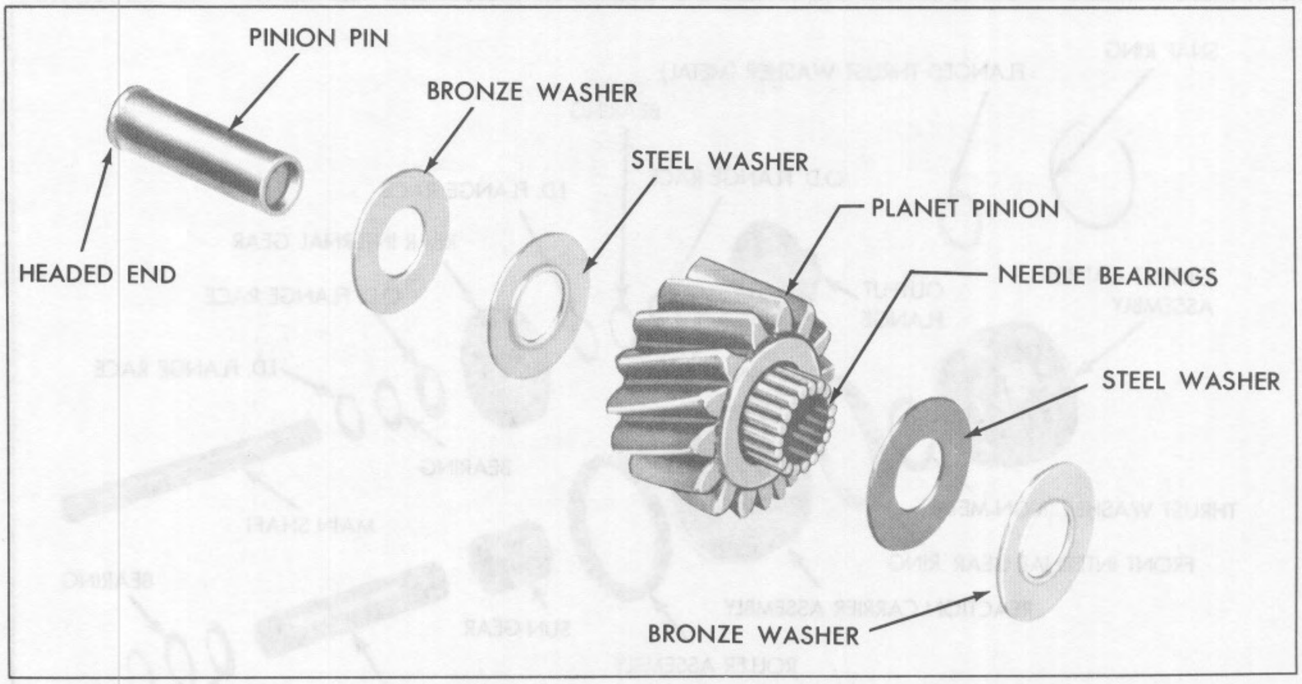


Fig. 7-158 Planet Pinion—Exploded View

h. Inspect Roller Clutch

1. Inspect roller clutch for damaged rollers or springs.
2. Inspect roller clutch cage for damage.

i. Inspect Sun Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Be sure oil lubrication hole is open.

j. Inspect Sun Gear Shaft

1. Inspect shaft for cracks or splits.
2. Inspect splines for damage.

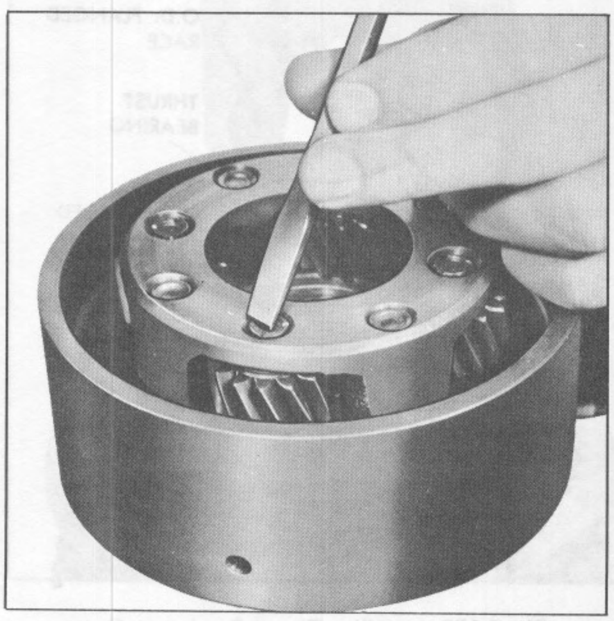


Fig. 7-159 Staking Pinion Pin

3. Inspect bushings for scoring or galling.
4. Inspect ground bushing journals for damage.
5. Be sure oil lubrication hole is open.

k. Assemble Gear Unit (Fig. 7-160)

1. Install rear internal gear on end of main shaft that has snap ring groove and install snap ring.
2. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install large diameter race first, with flange facing up, Fig. 7-161.
   b. Install thrust bearing in race.
   c. Install small diameter race on bearing with inner flange facing down.
3. Lubricate pinion gears in output carrier with transmission fluid and install output carrier on main shaft so that pinion gears mesh with rear internal gear.
4. Place assembly in a Rear Unit Holding Fixture, J-6116, with main shaft pointing downward. Be careful not to damage shaft.
5. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-162.
   b. Install thrust bearing in race.
   c. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.
6. Install output flange into output carrier and install snap ring.
7. Invert assembly and place on bench with output flange downward.
8. Lubricate tab side of reaction carrier to output carrier thrust washer with petrolatum and install thrust washer in output carrier with tabs in tab pockets.

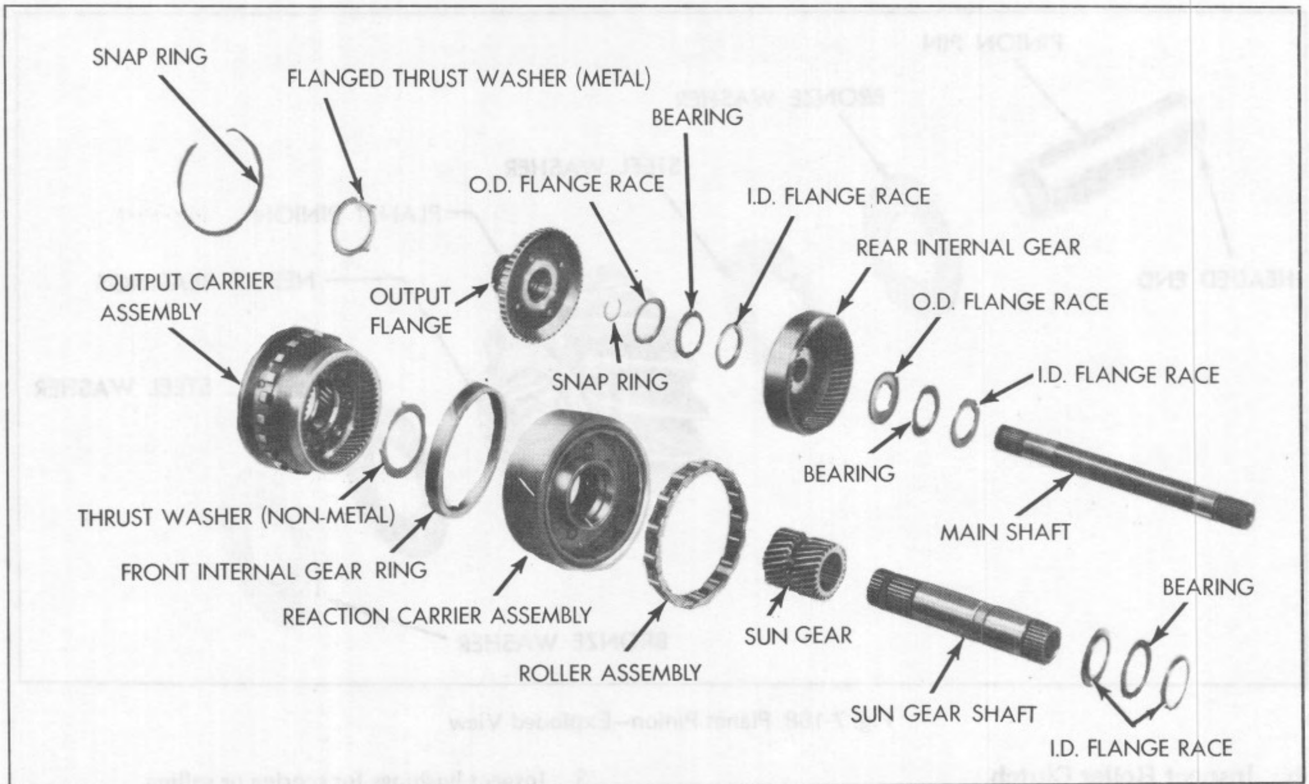


Fig. 7-160 Gear Unit–Exploded View

9. Install sun gear with end having chamfered I.D. facing down.

10. Install sun gear shaft with longer splined end down.

11. Install gear ring over output carrier.

12. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier so that pinion gears mesh with front internal gear.

(NOTE: When a new output carrier and/or reaction carrier is being installed, and if the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring. The front internal gear ring is a selective fit at the factory, but not in service.)

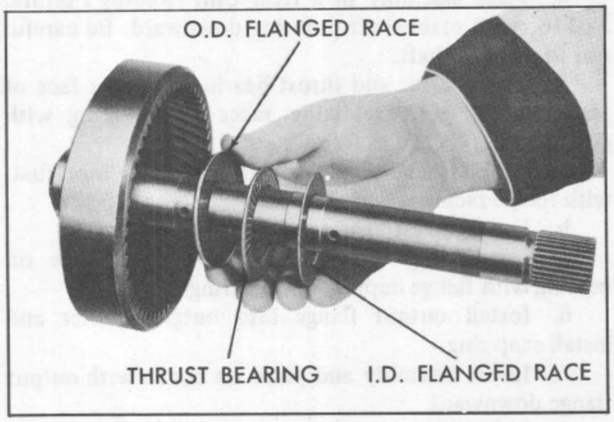


Fig. 7-161 Installing Thrust Bearing on Inner of Rear Internal Gear

13. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

14. Install thrust bearing on race.

15. Lubricate small diameter race with petrolatum and install race on center support with flange facing toward tower end, Fig. 7-163.

16. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with fore-

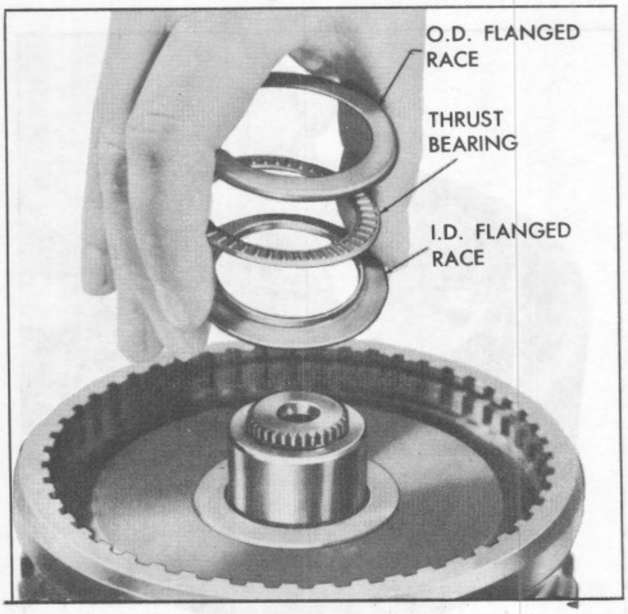


Fig. 7-162 Installing Thrust Bearing on Outer Face of Rear Internal Gear

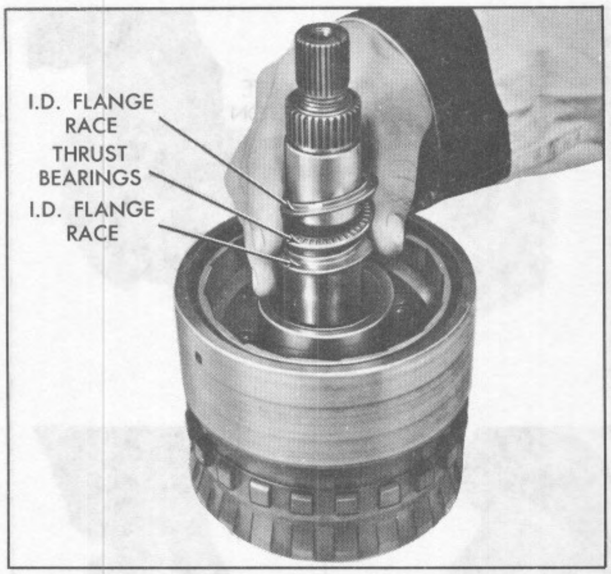


Fig. 7-163 Installing Thrust Bearing Over Sun Gear Shaft

finger and inserting roller from outer side, Fig. 7-164.

(NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.)

17. Install roller clutch assembly in reaction carrier, Fig. 7-165.

l. Disassemble Center Support and Intermediate Clutch Piston

1. Remove center support to reaction carrier thrust washer from recess in center support.
2. Remove four teflon oil seal rings from the center support, Fig. 7-166. All service center support oil seal rings are hook type cast iron.
3. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-167,

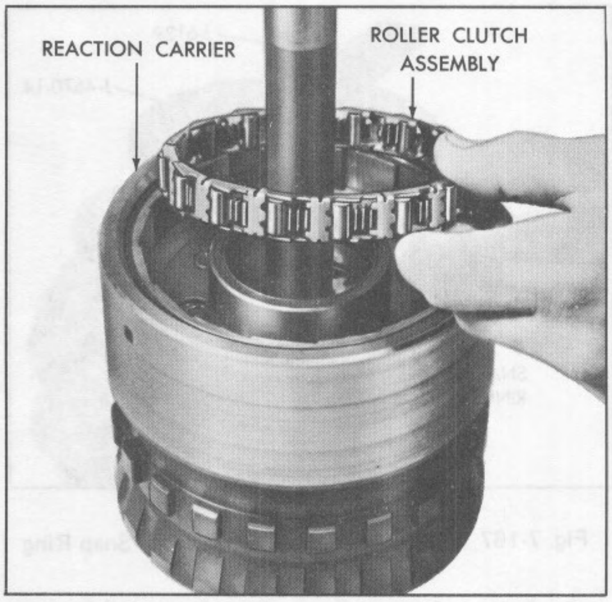


Fig. 7-165 Installing Roller Clutch in Reaction Carrier

compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

4. Remove spring retainer, six intermediate clutch release springs, and spring guide.
5. Remove intermediate clutch piston from center support.
6. Remove inner and outer seals from clutch piston.

(NOTE: Do not remove the three screws retaining roller clutch inner race to center support.)

m. Inspect Center Support

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.
2. Inspect bushing for scoring, wear or galling.
3. Check oil ring grooves for damage.
4. Air check oil passages to be sure they are open and not interconnected.

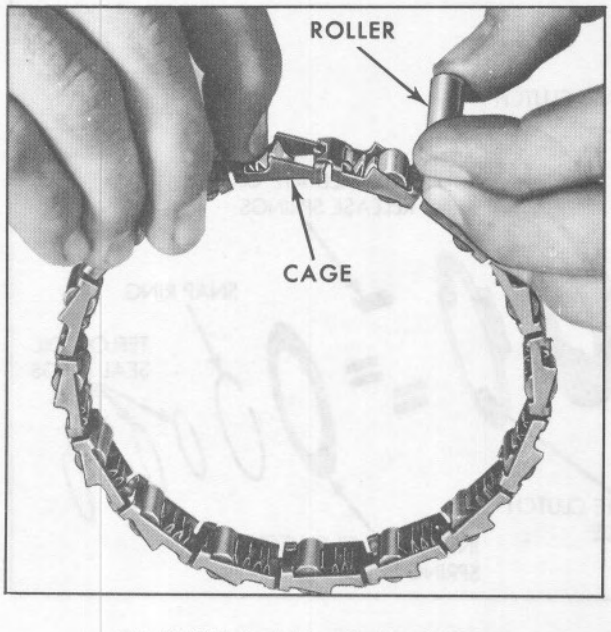


Fig. 7-164 Installing Rollers in Cage

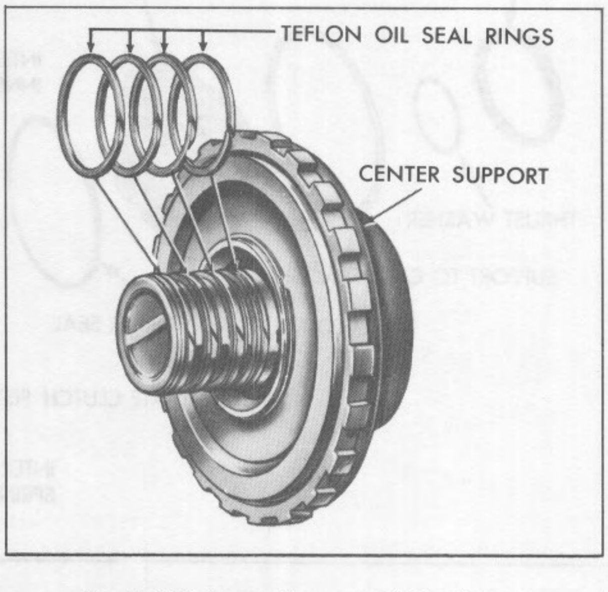


Fig. 7-166 Center Support Oil Seal Rings

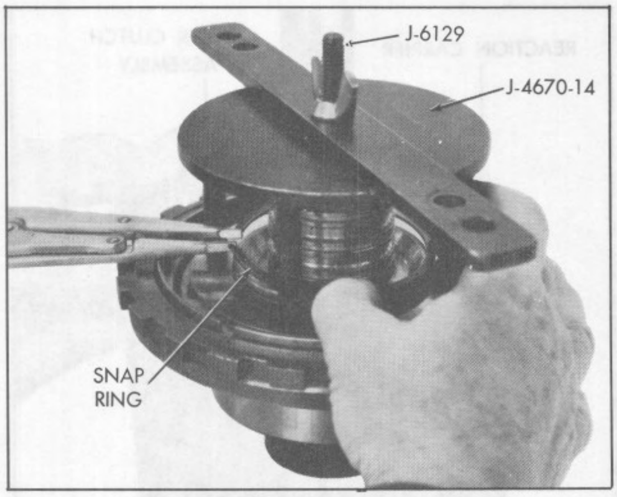


Fig. 7-167 Removing Intermediate Clutch Snap Ring

5. Inspect piston sealing surfaces for scratches.
6. Inspect piston seal grooves for nicks or other damage.
7. Inspect piston for cracks.
8. Inspect springs for collapsed coils or signs of distortion.
9. Inspect oil seal rings for damage.

(NOTE: All service center support oil seal rings are hook type cast iron.)

n. Assemble Center Support and Intermediate Clutch Piston Assembly (Fig. 7-168)

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring guide, Fig. 7-169.
2. Place Intermediate Clutch Inner Seal Protector,

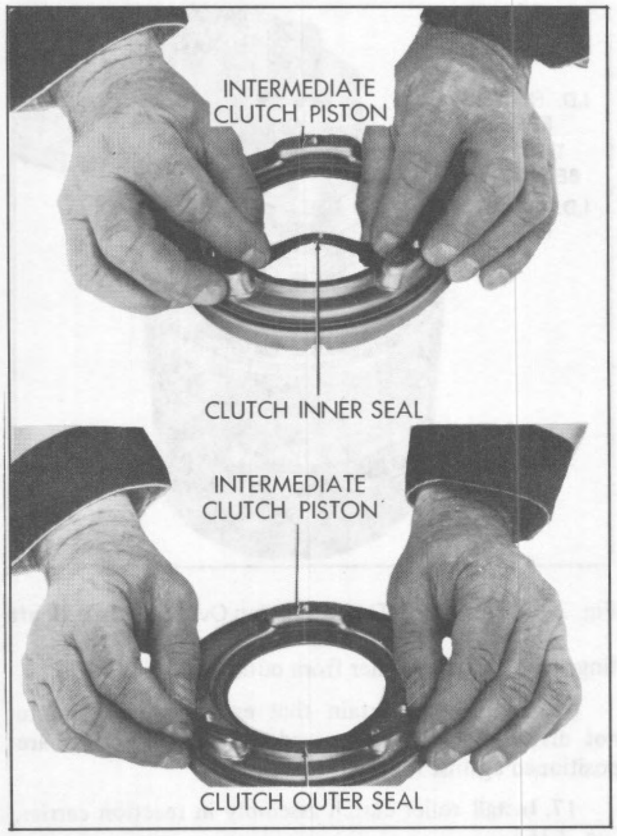


Fig. 7-169 Installing Intermediate Clutch Piston Seals

J-21363, over center support hub, Fig. 7-170, and install intermediate clutch piston.
3. Install plastic spring guide, Fig. 7-171.
4. Install six clutch release springs equally spaced into spring holes in spring guide, Fig. 7-172.
5. Place spring retainer and snap ring over springs.
6. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-167,

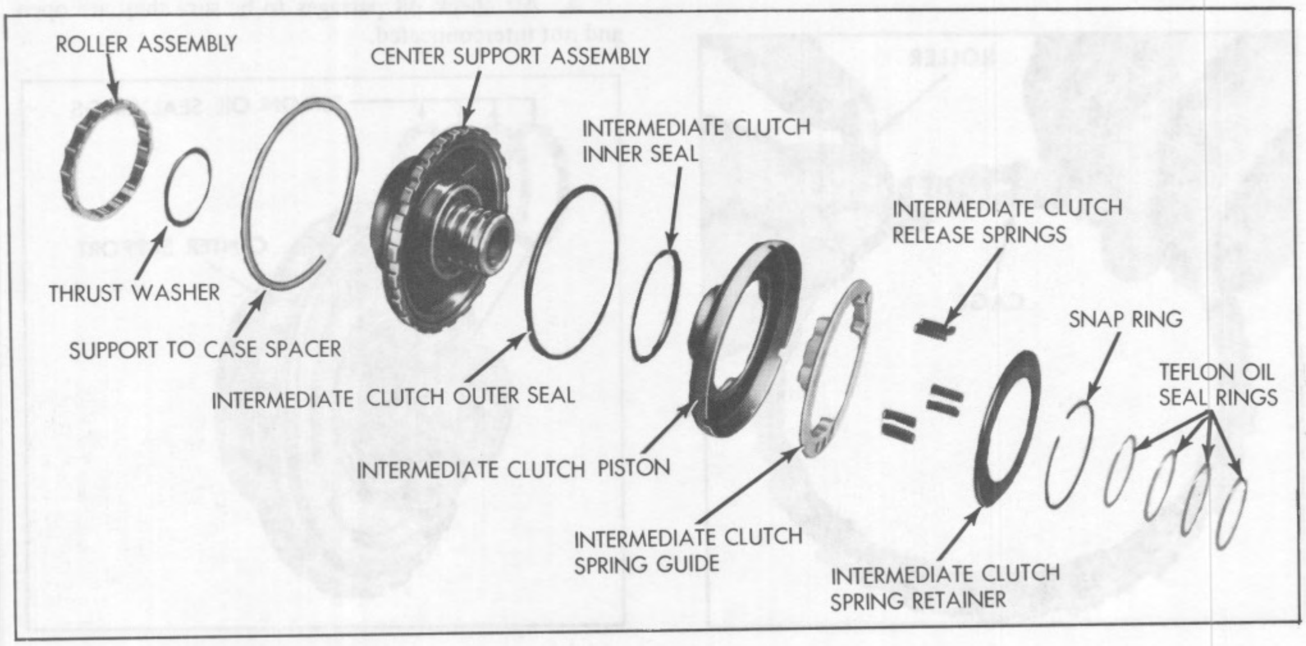


Fig. 7-168 Center Support Assembly—Exploded View

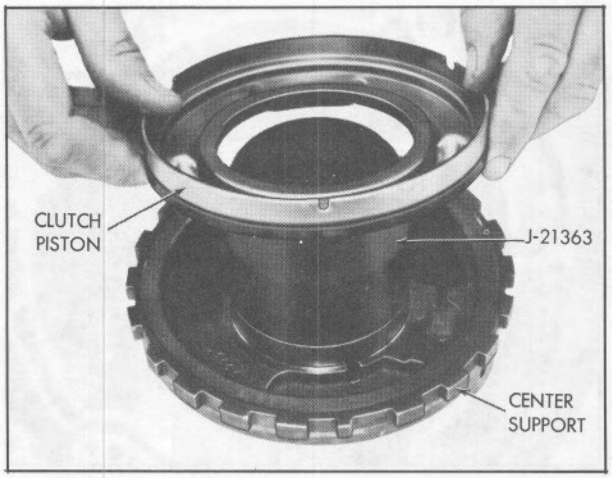


Fig. 7-170 Installing Intermediate Clutch Piston

compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

7. Install four teflon oil seal rings on the center support.

8. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch piston, Fig. 7-173.

9. Lubricate center support to reaction carrier thrust washer with petrolatum and install washer in recess of center support, Fig. 7-174. Check to make sure sun gear thrust bearing race is on center support.

10. Install center support assembly into roller clutch in reaction carrier, Fig. 7-175.

(NOTE: With reaction carrier held, center support should turn clockwise only.)

11. Install Gear Assembly Remover and Installer Adapter, J-21795, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on tool to secure tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly, Fig. 7-152.

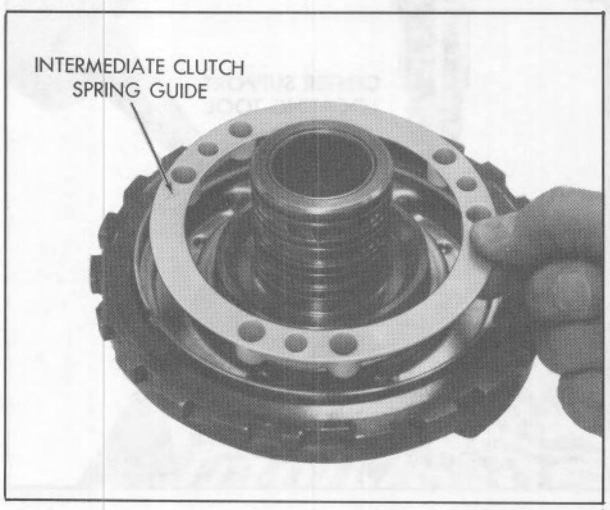


Fig. 7-171 Installing Spring Guide

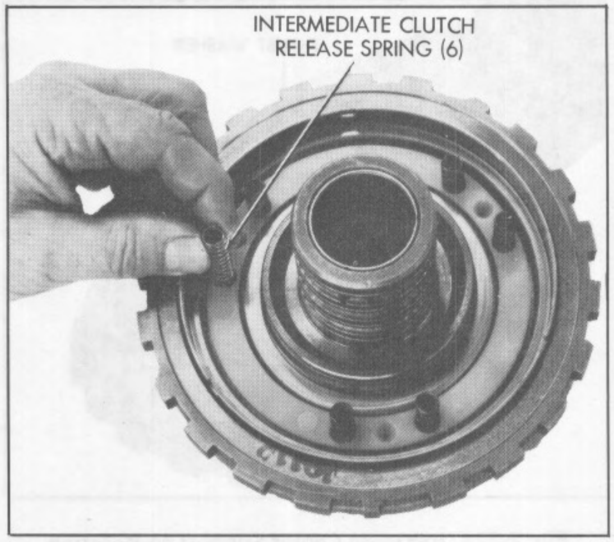


Fig. 7-172 Installing Clutch Release Springs

o. Install Rear Band and Complete Gear Unit Assembly

1. Inspect rear band for cracks or distortion and band ends for damage to anchor lugs and apply lug. Also inspect lining for cracks, flaking, burning and looseness.

2. Install rear band assembly in transmission case so that band lugs index with anchor pins.

3. Inspect support to case spacer for burrs or raised edges. If present, remove with a stone or fine sandpaper.

4. Install the support case spacer against the shoulder at the bottom of case splines and the gap located adjacent to the band anchor pin, Fig. 7-176.

CAUTION: Do not confuse this spacer (.040" thick and both sides flat) with either the center support to case snap ring (one side beveled) or the intermediate clutch backing plate to case snap ring (.093" thick and both sides flat).

5. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

(NOTE: Proper washer size was determined at time of rear unit end play check.)

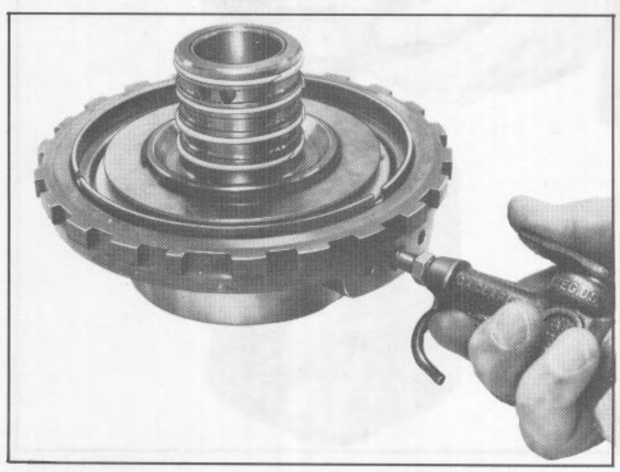


Fig. 7-173 Air Checking Intermediate Clutch

Fig. 7-174 Installing Center Support-to-Reaction Carrier Thrust Washer

6. Laying gear unit on its side, install metal thrust washer on output flange with bent tabs in tab pockets. Retain thrust washer with petrolatum.

CAUTION: Be careful not to drop or bump gear unit assembly in transmission case during installation.

7. Install gear unit, with center support and reaction carrier, by lining up center support bolt hole with hole in case and carefully guiding complete assembly into transmission case.

8. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, (flat side against center support) locating gap adjacent to front band anchor pin. Expand snap ring until center support is against shoulder of case.

9. Install case to center support bolt.

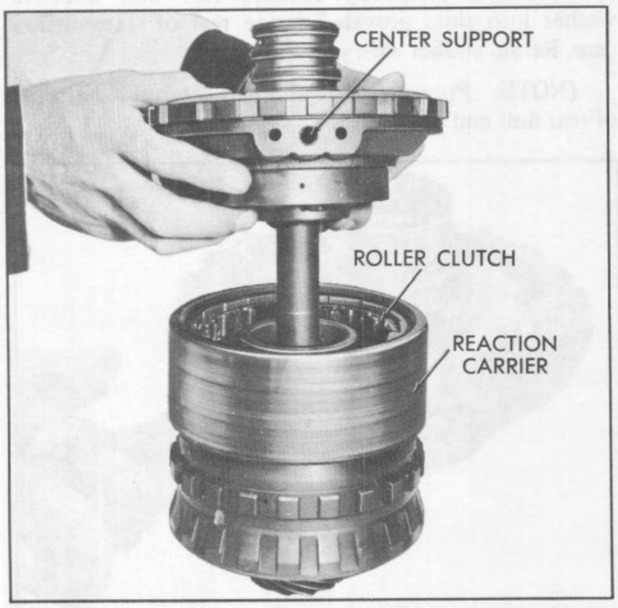


Fig. 7-175 Installing Center Support to Reaction Carrier

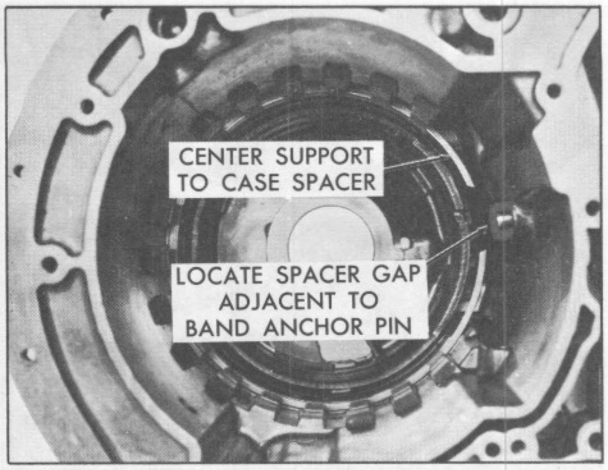


Fig. 7-176 Installing Support-to-Case Spacer

(NOTE: To correctly perform this operation, it will be necessary to make the tool shown in Fig. 7-101. Then follow procedure outlined below:)

Place center support locating tool into the case direct clutch passage, with the handle of the tool pointing to the left, as viewed from the front of transmission and parallel to the bell housing mounting, Fig. 7-177.

Lift upward on the tool which will tend to rotate the center support counterclockwise as viewed from the front of transmission. While holding the center support firmly counterclockwise against case splines, torque case to center support bolt to 23 ft. lbs., using a 3/8" 12-point thin-wall deep socket.

CAUTION: When using the locating tool, care should be taken not to raise burrs on the case valve mounting face.

10. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

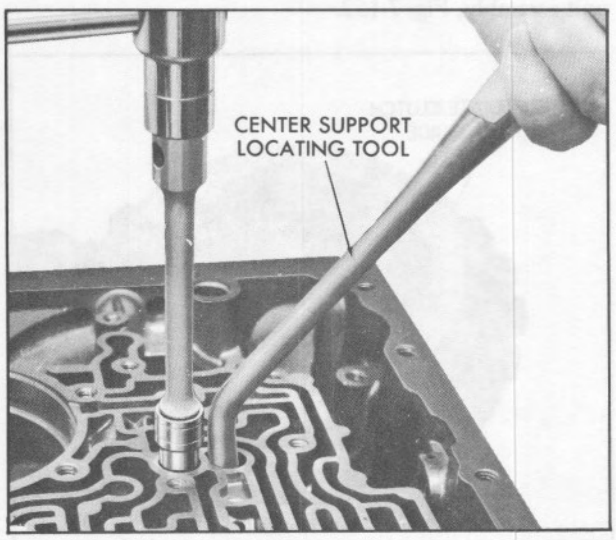


Fig. 7-177 Locating Center Support

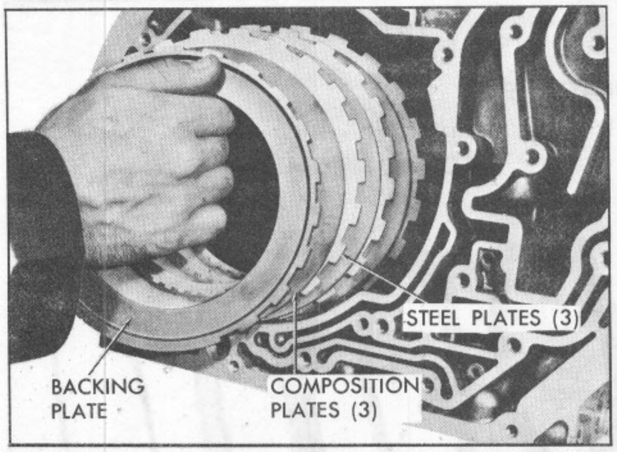


Fig. 7-178 Installing Intermediate Clutch Plates

11. Lubricate three steel and three composition intermediate clutch plates with transmission fluid and install clutch plates in transmission case, Fig. 7-178. Start with steel plate and alternate composition and steel plates.

12. Install intermediate clutch backing plate with flat machine surface against clutch plates.

13. Install backing plate to case snap ring with snap ring gap on side of case opposite front band anchor pin.

(NOTE: Both sides of this snap ring are flat, and it is approximately .093" thick.)

14. Recheck rear unit end play as described in Note 84.

88. Direct Clutch and Intermediate Sprag Assembly (Fig. 7-179)

a. Disassembly

1. Remove sprag retainer snap ring, and remove clutch retainer.
2. Remove sprag outer race and bushings, and remove sprag assembly from outer race.
3. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.
4. Remove direct clutch backing plate and six composition and six steel clutch plates, Fig. 7-180.
5. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-181 compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.
6. Remove tools, spring retainers, and fourteen clutch release springs. Keep springs separate from forward clutch springs.
7. Remove direct clutch piston from direct clutch housing.
8. Remove inner and outer seals from clutch piston.
9. Remove center piston seal from direct clutch housing.

b. Inspection

1. Inspect sprag assembly for popped or loose sprags.
2. Inspect sprag bushing for wear or distortion.
3. Inspect inner and outer races for scratches or wear.

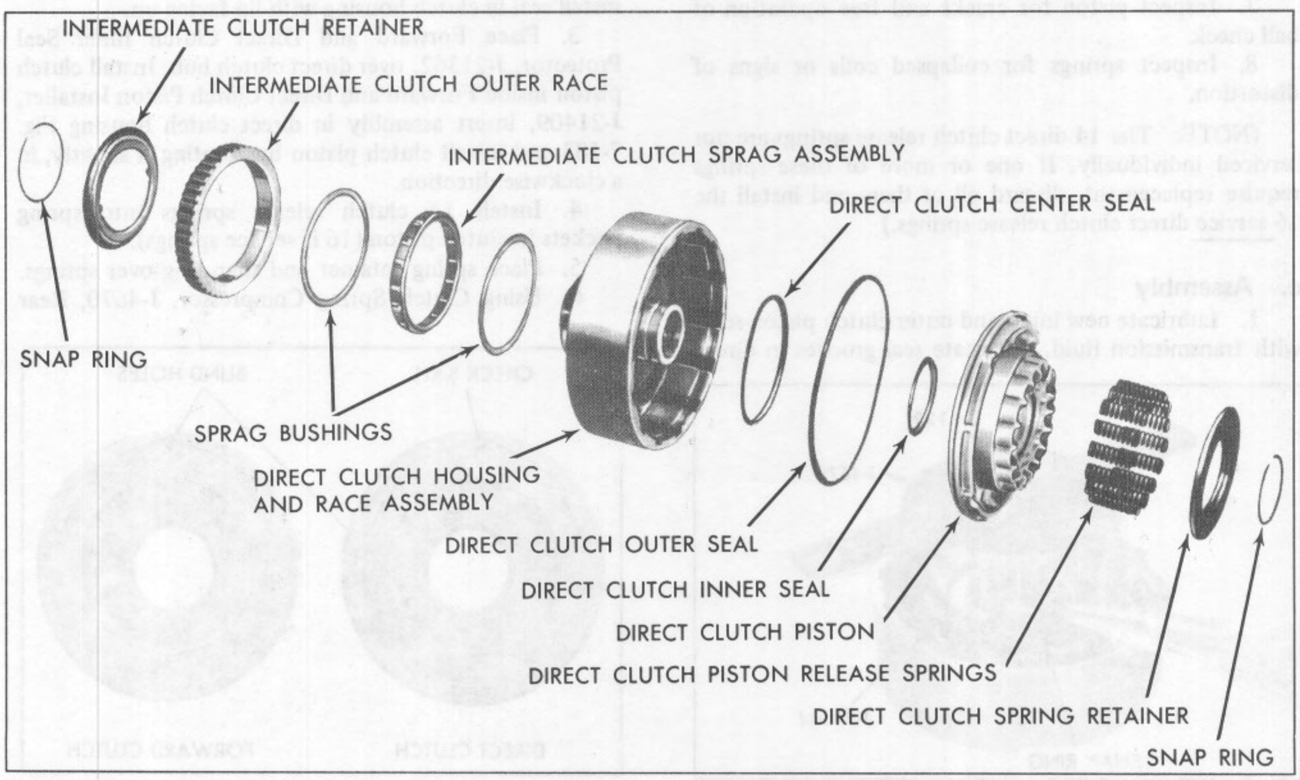


Fig. 7-179 Direct Clutch and Piston—Exploded View

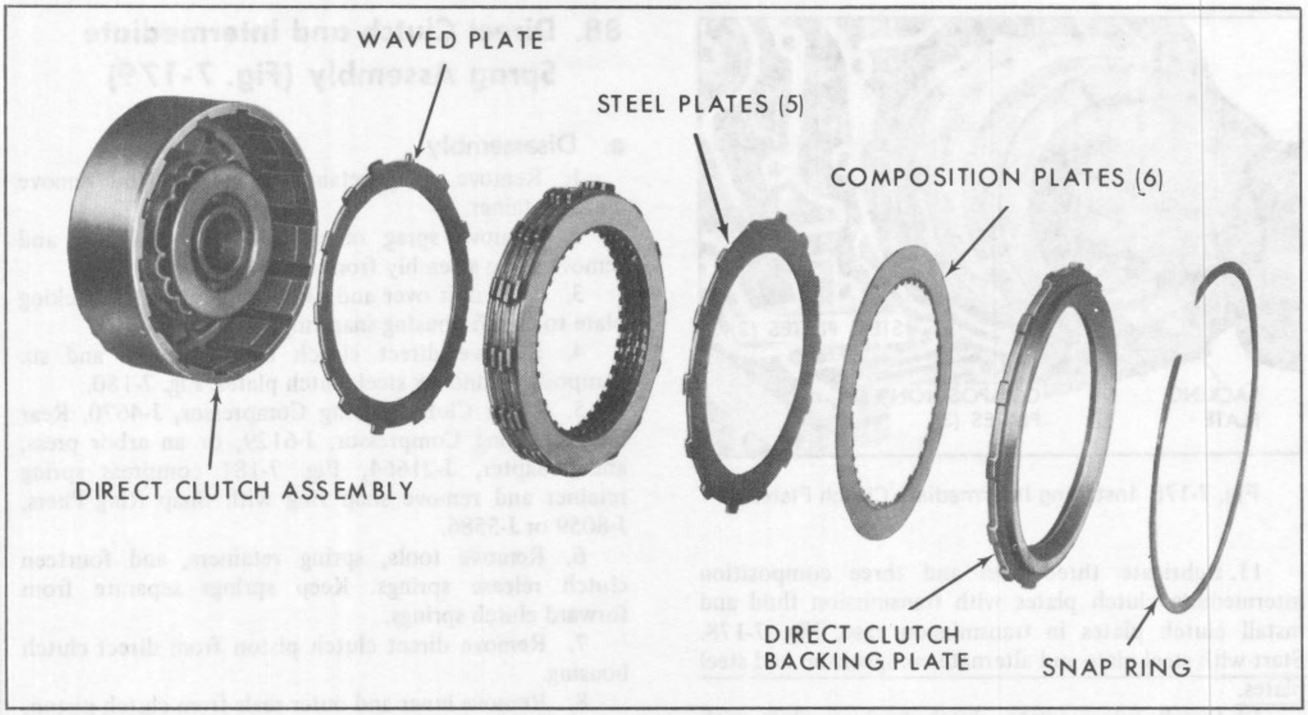


Fig. 7-180 Direct Clutch—Exploded View

4. Inspect clutch housing for cracks, wear, proper openings of oil passages and wear on clutch plate drive lugs.

5. Inspect composition faced and steel clutch plates for sign of wear or burning.

6. Inspect backing plate for scratches or other damage.

7. Inspect piston for cracks and free operation of ball check.

8. Inspect springs for collapsed coils or signs of distortion.

(NOTE: The 14 direct clutch release springs are not serviced individually. If one or more of these springs require replacement, discard all of them and install the 16 service direct clutch release springs.)

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct clutch piston and install seals with lips facing away from spring pockets.

(NOTE: Make certain piston has ball check, Fig. 7-182.)

2. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.

3. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing Fig. 7-183 and install clutch piston by rotating it slightly, in a clockwise direction.

4. Install 14 clutch release springs into spring pockets in clutch piston (16 if service springs).

5. Place spring retainer and snap ring over springs.

6. Using Clutch Spring Compressor, J-4670, Rear

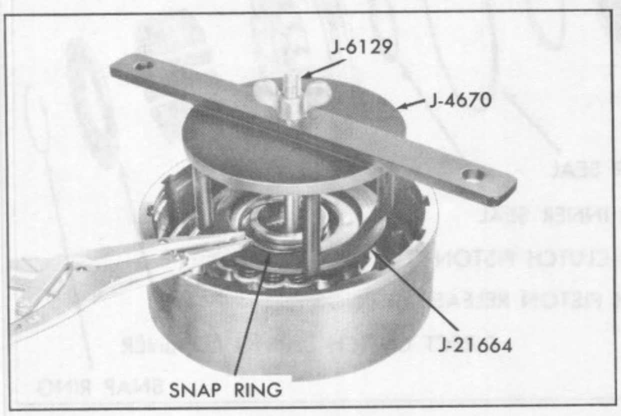


Fig. 7-181 Removing Direct Clutch Snap Ring

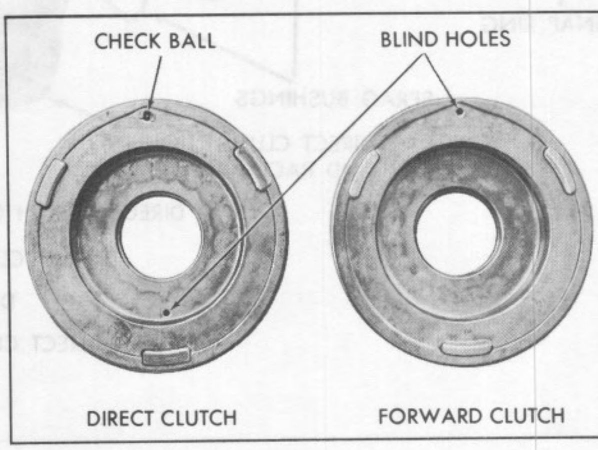


Fig. 7-182 Direct Clutch Identification

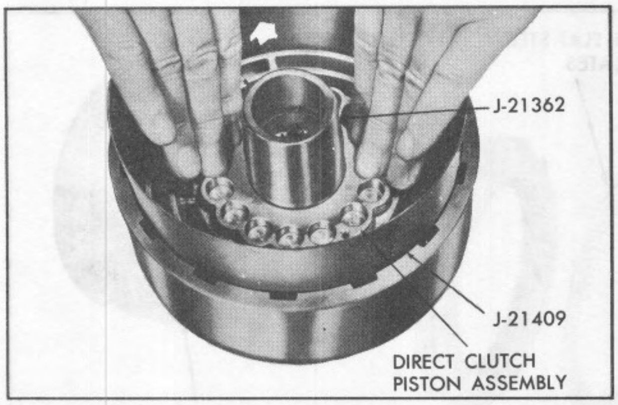


Fig. 7-183 Installing Direct Clutch Piston

Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-181, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

(NOTE: Make certain clutch release springs are not leaning. If necessary, straighten springs with a small screwdriver.)

7. Lubricate the five flat and one waved (plate with "U" notch) and steel and six composition clutch plates with transmission fluid and install clutch plates in direct clutch housing. Start with waved steel plate and alternate composition and flat steel clutch plates. Fig. 7-184.

8. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

9. Invert clutch housing and install one sprag bushing, cup side up, around sprag inner race.

10. Install sprag assembly into clutch outer race.

11. With ridge on inner cage of sprag facing up install sprag and outer race on inner race with counterclockwise turning motion.

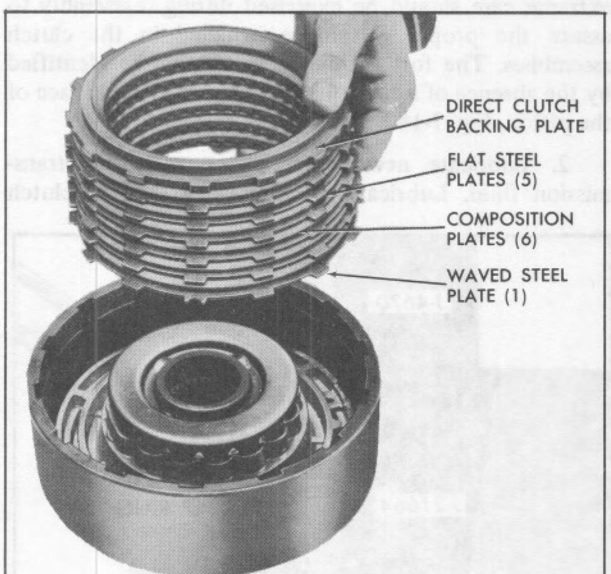


Fig. 7-184 Installing Direct Clutch Plates

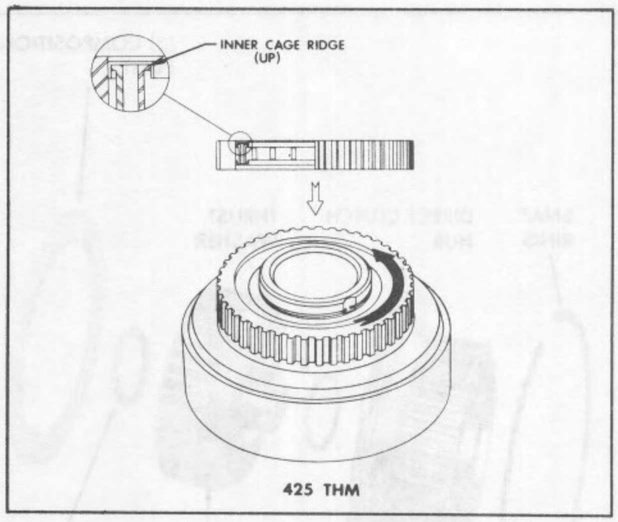


Fig. 7-185 Sprag Rotation

(NOTE: When installed, outer race should turn only counterclockwise, Fig. 7-185).

12. Install sprag bushing, cup side down, over sprag assembly.

13. Install sprag retainer and snap ring.

d. Install Front Band and Direct Clutch Assembly

1. Inspect front band for cracks or distortion and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

2. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-186.

3. Install direct clutch housing and intermediate sprag assembly. Make certain that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing.

(NOTE: It will be necessary to rotate clutch housing to allow sprag outer race to index with inter-

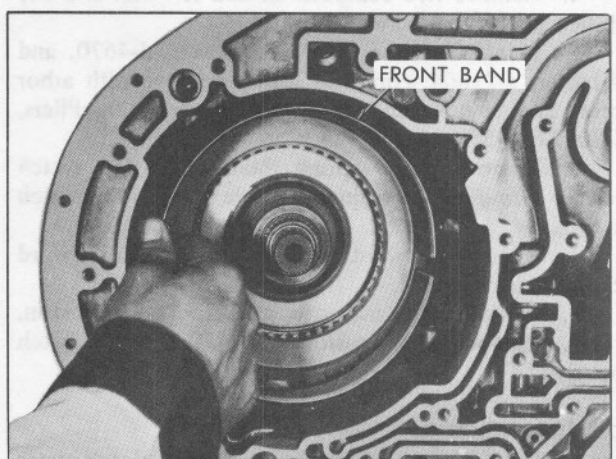


Fig. 7-186 Installing Front Band

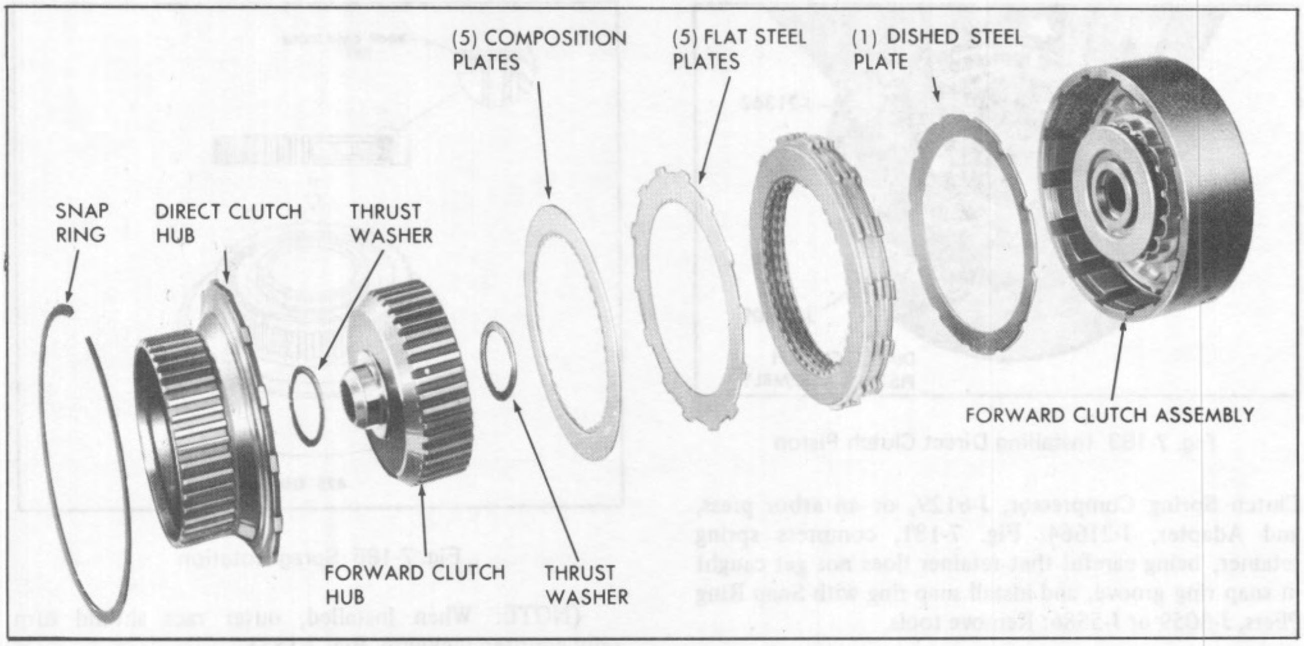


Fig. 7-187 Forward Clutch Assembly—Exploded View

mediate composition clutch plates. Removal of direct clutch composition-faced and steel plates may be helpful, and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.)

4. Check operation of direct clutch by applying air pressure through direct clutch passage next to center support bolt, Fig. 7-72.

89. Forward Clutch Assembly

a. Disassembly (Fig. 7-187)

1. Remove forward clutch housing to direct clutch hub snap ring.
2. Remove direct clutch hub.
3. Remove forward clutch hub and one thrust washer from inner side of hub.
4. Remove five composition and five flat and one dished steel clutch plates.
5. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-188.
6. Remove tools, spring retainer and 16 clutch release springs. Keep springs separate from direct clutch springs.
7. Remove forward clutch piston from forward clutch housing.
8. Remove inner and outer seals from clutch piston.
9. Remove center piston seal from forward clutch housing.

b. Inspection

1. Inspect composition-faced and steel clutch plates for signs of burning, scoring or wear.
2. Inspect sixteen release springs for collapsed coils or signs of distortion.
3. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.
4. Inspect piston for cracks.
5. Inspect clutch housing
5. Inspect clutch housing for wear, scoring, cracks and open oil passages.

c. Assembly (Fig. 7-189)

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.

(NOTE: The forward and direct clutch pistons have identical inside and outside diameters. Therefore, extreme care should be exercised during reassembly to assure the proper piston be installed in the clutch assemblies. The forward clutch piston can be identified by the absence of a check ball in the clutch apply face of the piston, Fig. 7-182.)

2. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch

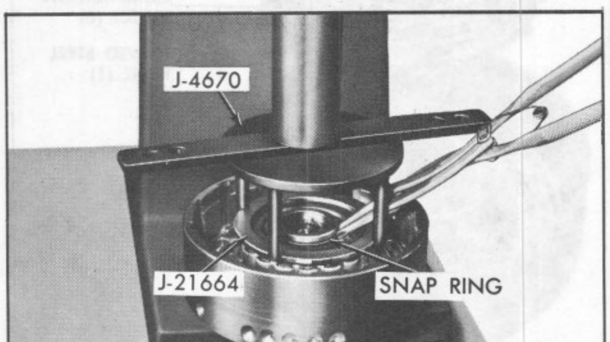


Fig. 7-188 Installing Forward Clutch Snap Ring

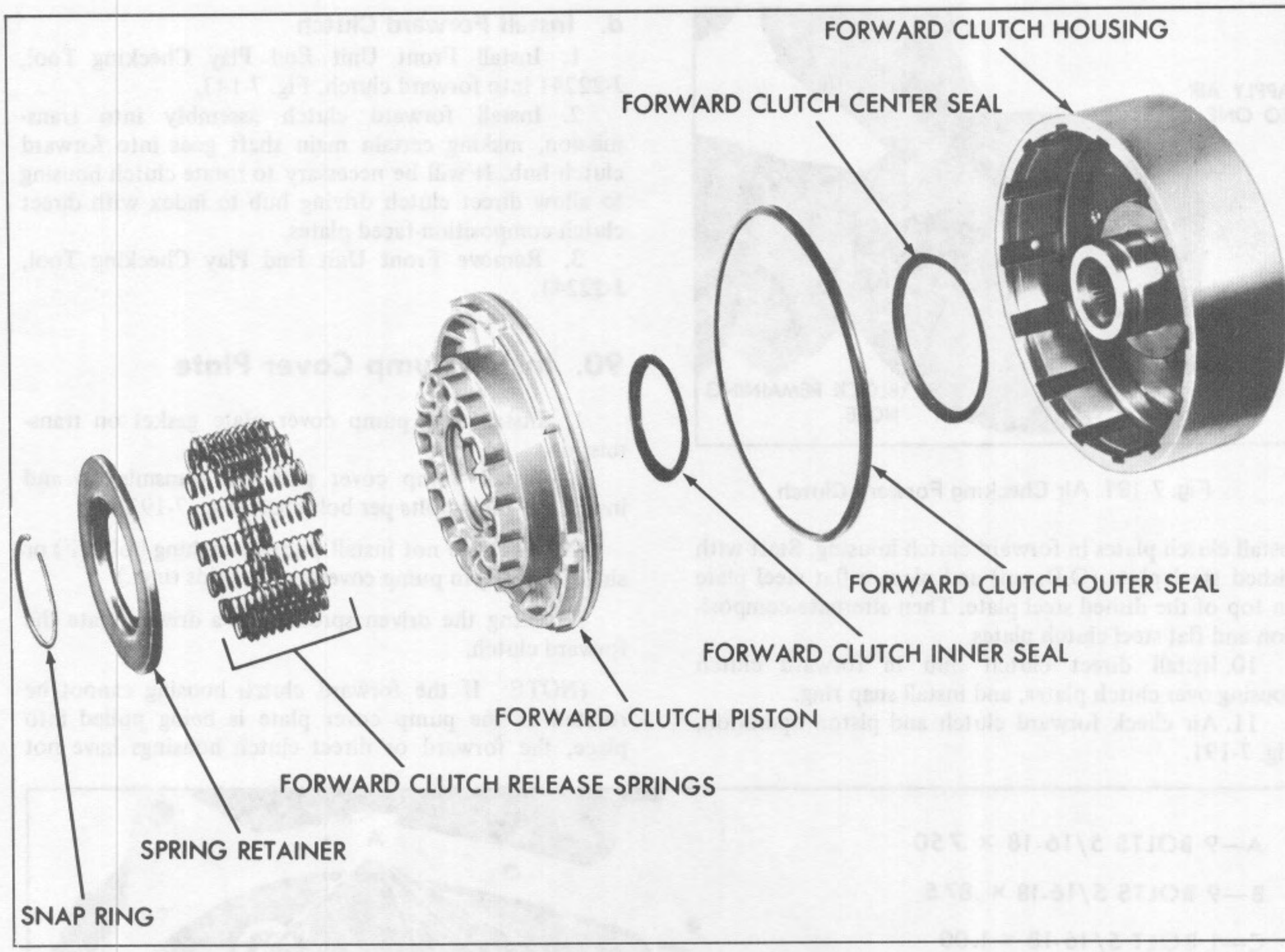


Fig. 7-189 Forward Clutch—Exploded View

housing with petrolatum and install seal into clutch housing with lip facing up.

3. Place forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-189 and install clutch piston by rotating it slightly in a clockwise direction until seated, Fig. 7-190.

4. Install sixteen clutch release springs into spring pockets in clutch piston.

5. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-188 and remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

6. Remove forward clutch assembly from arbor press and place on work bench.

7. Install the forward clutch hub thrust washers on the forward clutch hub. Retain with petrolatum.

8. Install forward clutch hub in forward clutch housing.

9. Lubricate the dished and five flat steel and five composition clutch plates with transmission fluid and

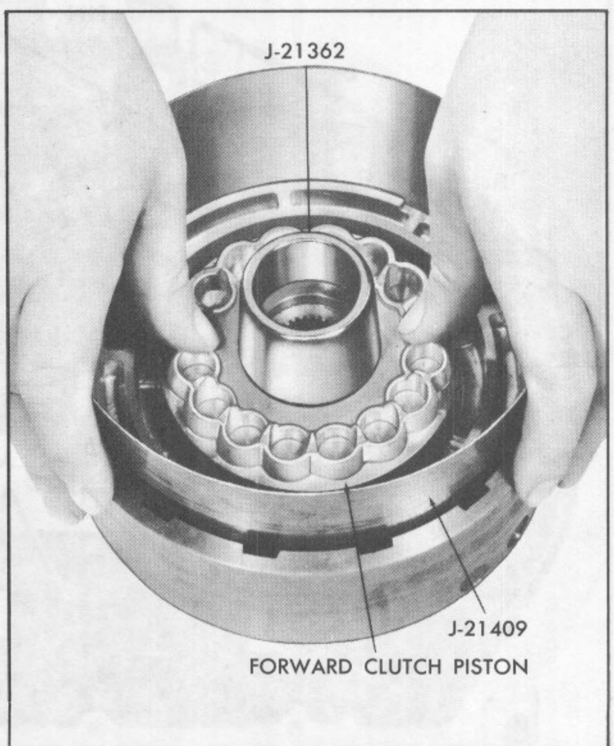


Fig. 7-190 Installing Forward Clutch Piston

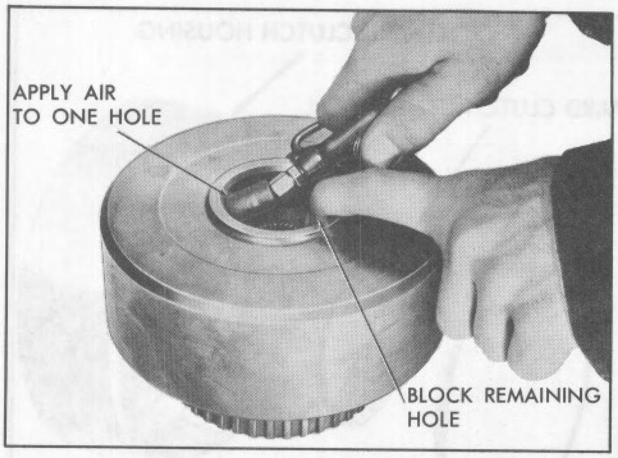


Fig. 7-191 Air Checking Forward Clutch

install clutch plates in forward clutch housing. Start with dished steel plate (O.D. up) and place a flat steel plate on top of the dished steel plate. Then alternate composition and flat steel clutch plates.

10. Install direct clutch hub in forward clutch housing over clutch plates, and install snap ring.

11. Air check forward clutch and piston operation, Fig. 7-191.

d. Install Forward Clutch

1. Install Front Unit End Play Checking Tool, J-22241 into forward clutch, Fig. 7-143.

2. Install forward clutch assembly into transmission, making certain main shaft goes into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch composition-faced plates.

3. Remove Front Unit End Play Checking Tool, J-22241.

90. Install Pump Cover Plate

1. Install new pump cover plate gasket on transmission.

2. Install pump cover plate on transmission and install attaching bolts per bolt chart, Fig. 7-192.

(NOTE: Do not install pump attaching bolts (F) or single bolt (E) in pump cover plate at this time.)

3. Using the driven sprocket as a driver rotate the forward clutch.

(NOTE: If the forward clutch housing cannot be rotated as the pump cover plate is being pulled into place, the forward or direct clutch housings have not

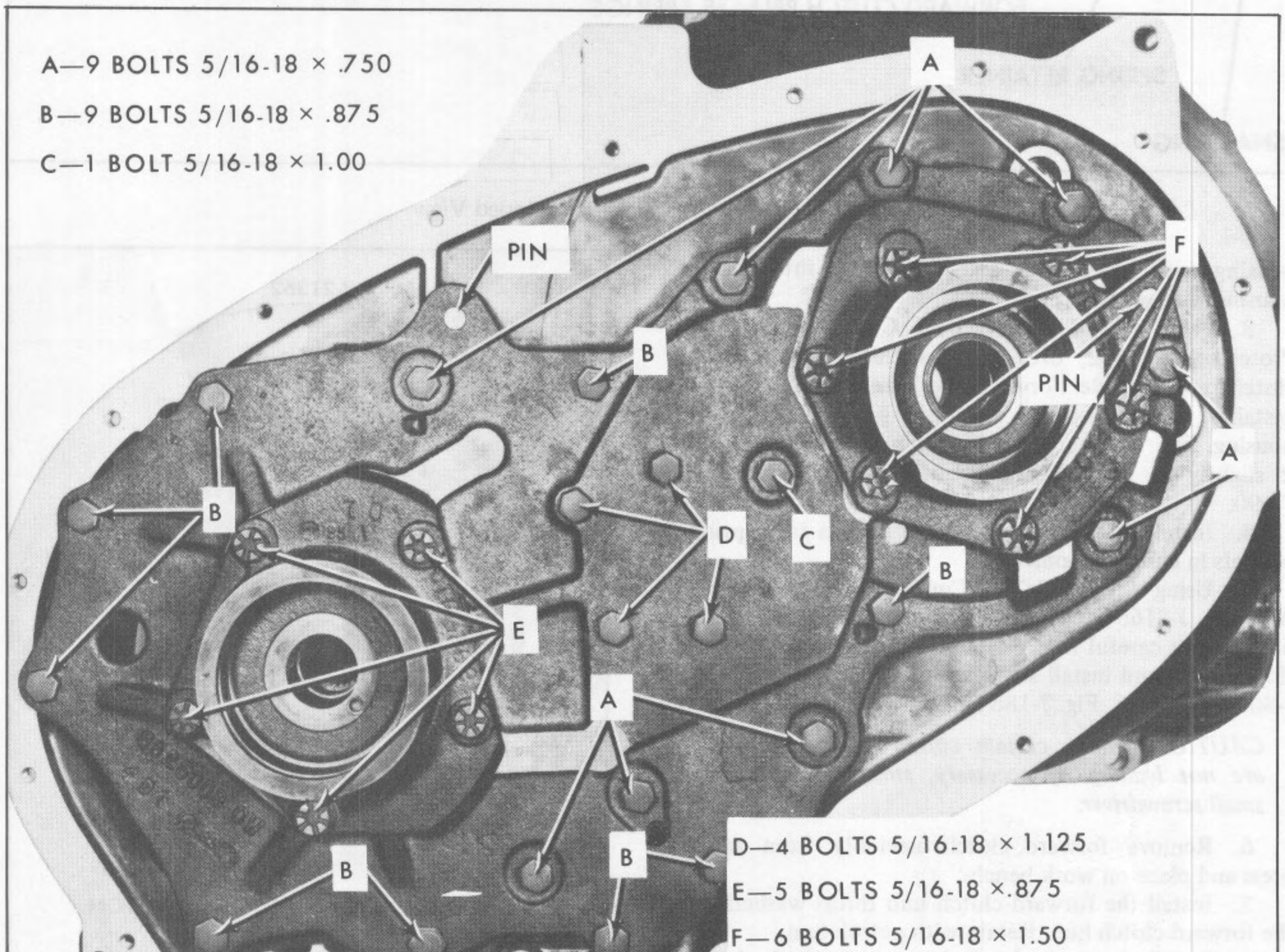


Fig. 7-192 Pump Cover Plate Screws

been properly installed to index with all the clutch plates. This condition must be corrected before the pump cover plate is pulled fully into place.)

4. Torque all bolts to 20 foot-pounds.
5. Repeat front unit end play check as described in Note 80.
6. Install remaining bolt (E) in driven support housing, tightening to 20 foot-pounds.

91. Oil Pump

a. Disassembly

1. Mark drive and driven gears for reassembly in same position and remove the pump body.

(NOTE: Installing the gears in the same position as removed will assure the quietest operation, as the gear teeth will mesh in the established wear pattern.)

2. Remove drive and driven gears from pump body.
3. Remove and discard pump body to case square-cut O-ring seal.

b. Inspection

1. Using tip of finger, inspect gear pocket and crescent for nicks, burrs, scoring or galling.
2. Inspect drive gear for nicks, burrs, scoring, or galling.
3. Inspect driven gear for nicks, burrs, scoring, or galling.
4. Place pump gears in pump body and check pump body face to gear face clearance. Clearance should be .0013" - .0035".
5. Check face of pump body for nicks, burrs, scoring, or galling.
6. Check pump body face flatness. Overall flatness should be .000" to .002".
7. Inspect bushing for nicks, burrs, scoring, galling, out-of-round, or excessive wear.

(NOTE: To check for out-of-round, install pump body on the converter hub and look for eccentricity between pump bushing and converter hub.)

8. Check for damaged pump cover plate bolt holes.
9. Inspect front seal for damage. If replacement of front seal is necessary, use a standard 3/4" cold chisel and pry front seal pump body, Fig. 7-193.

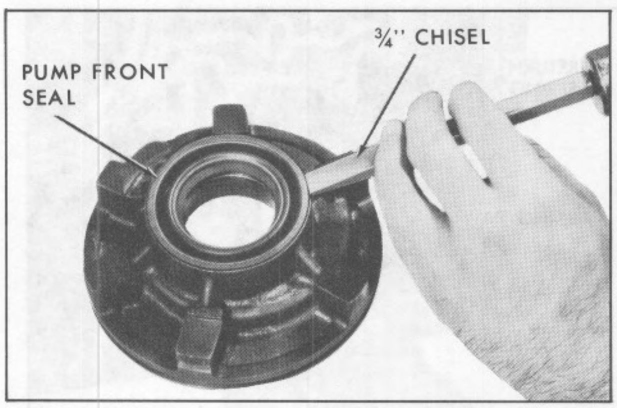


Fig. 7-193 Removing Pump Front Seal

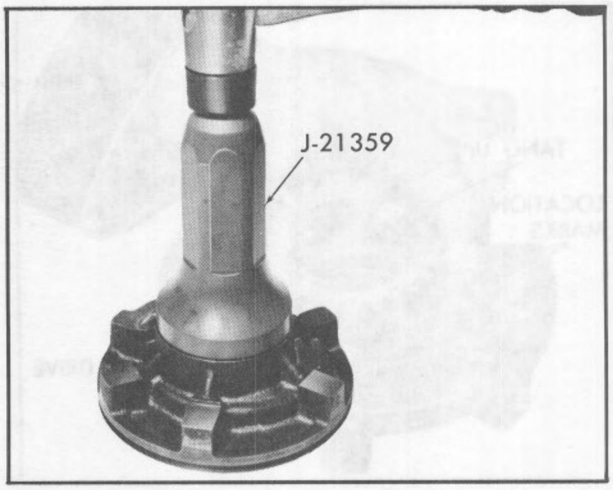


Fig. 7-194 Installing Pump Front Seal

c. Assembly

1. If necessary, install a new front seal, using Pump Oil Seal Installer, J-21359, to drive seal into place. Use a non-hardening sealer on outside of seal before installing into pump, Fig. 7-194.
2. Install new pump to case square-cut O-ring seal, Fig. 7-195.
3. Install driven gear into pump body with alignment mark up.
4. Install drive gear into pump body with drive tangs up, Fig. 7-196.

(NOTE: Drive gear should always be installed with counterbore down.)

d. Installation

1. Rotate transmission in holding fixture base so that cored oil passages are up.
2. Install pump assembly over stator shaft and position to drive support housing, rotating pump as necessary to align holes in pump cover plate with pump attaching bolt holes.
3. Install six retaining bolts (F), finger tight, Fig. 7-192.
4. Rotate transmission in holding fixture base so that pump cover plate is up.
5. Tighten pump attaching bolts to 20 ft. lbs.

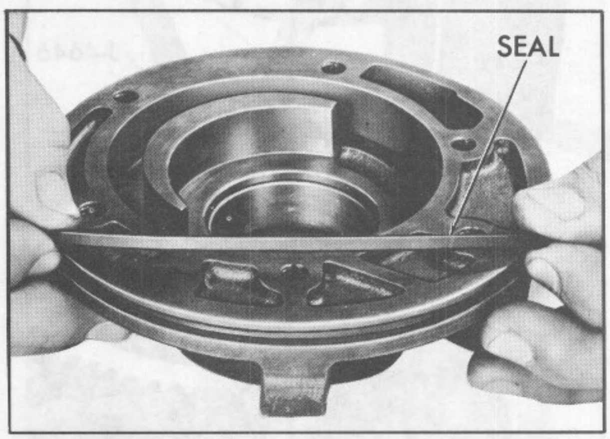


Fig. 7-195 Installing Pump-to-Case Seal

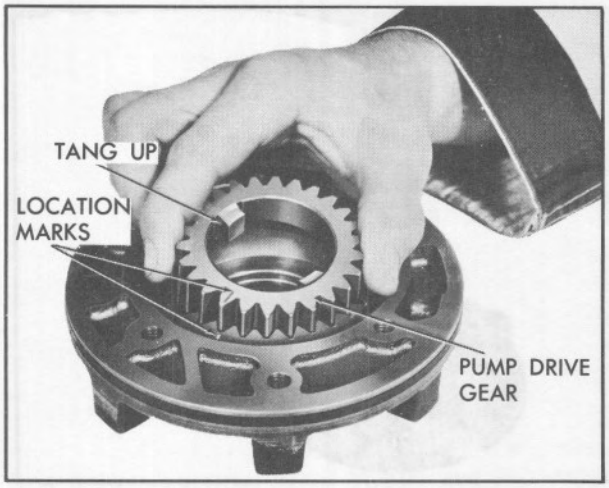


Fig. 7-196 Installing Pump Drive Gear

92. Install Sprockets, Link Assembly and Sprocket Cover

1. Rotate transmission in holding fixture base so that cored oil passages are up.
2. Position drive and driven sprockets on workbench with shafts up, and drive sprocket closest to transmission.
3. Install link assembly over drive and driven sprockets with colored guide link, which has etched numerals, down.
4. Lift sprockets and link assembly and rotate assemblies 90° so that drive sprocket is up.
5. Allowing driven sprocket to hang down freely, start turbine shaft into pump support housing until it will support weight of assembly.
6. Start input shaft into driven support housing, and alternately push shafts inward until sprockets are installed.
7. Rotate transmission in holding fixture base so that sprockets are up.

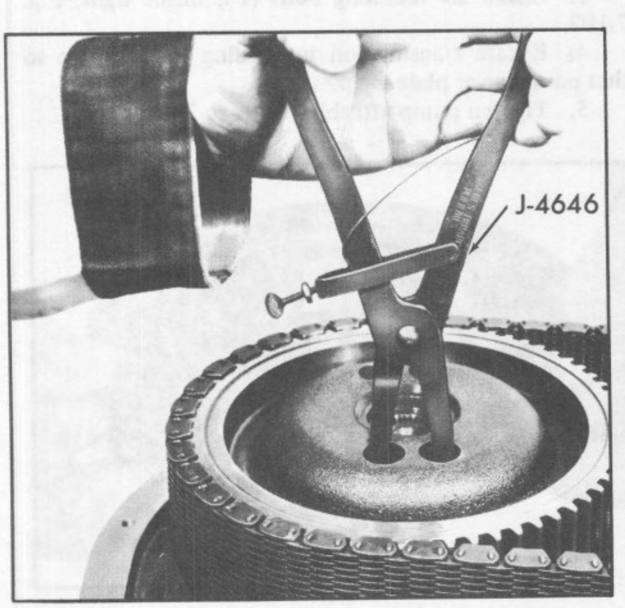


Fig. 7-197 Installing Sprocket Snap Ring

8. Using a plastic mallet, gently tap sprockets to seat sprocket bearing assemblies into support housing.
9. Install Snap Ring Pliers, J-4646, into sprocket bearing retainer snap rings, located under the drive and driven sprockets, and install snap rings into retaining grooves on support housings, Fig. 7-197.
10. Install new sprocket cover to case gasket on transmission case.
11. Position sprocket cover to transmission case and install 18 attaching bolts, tightening bolts to 8 ft. lbs.

(NOTE: One sprocket cover attaching bolt is 1/4 inch longer. This bolt must be installed in the tapped hole directly over the cooler fittings on the transmission case.)

93. Detent Lever, Manual Shaft, Parking Linkage, Rear Servo, Front Servo, Check Balls, and Control Valve Spacer

a. Inspect Detent Lever, Manual Shaft, and Parking Linkage

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs.
2. Inspect actuator spring for damage.
3. Inspect actuator for a free fit on actuator rod.
4. Inspect parking pawl for cracks or wear.
5. Inspect manual shaft for damaged threads.
6. Inspect inside detent lever for cracks or a loose pin.
7. Inspect parking pawl return spring for deformed coils or ends.
8. Inspect parking bracket for cracks or wear.
9. Inspect detent spring and roller assembly.

b. Install Detent Lever, Manual Shaft and Parking Linkage

1. Install parking pawl (tooth toward inside of case), pawl return spring and parking pawl shaft into case, Fig. 7-198.
2. Install parking pawl shaft retaining pin into case hole.
3. Install parking bracket into case, tightening attaching screws to 18 ft. lbs.

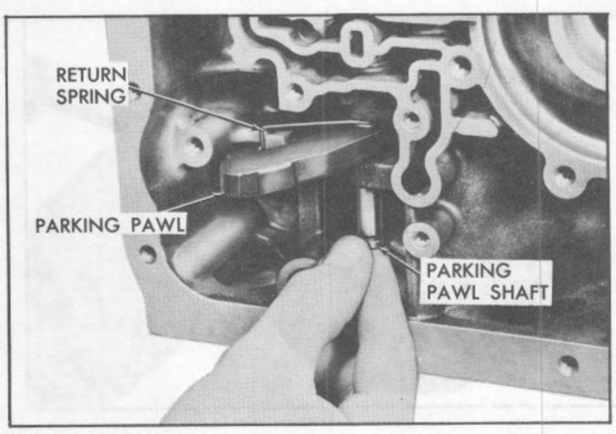


Fig. 7-198 Installing Parking Pawl

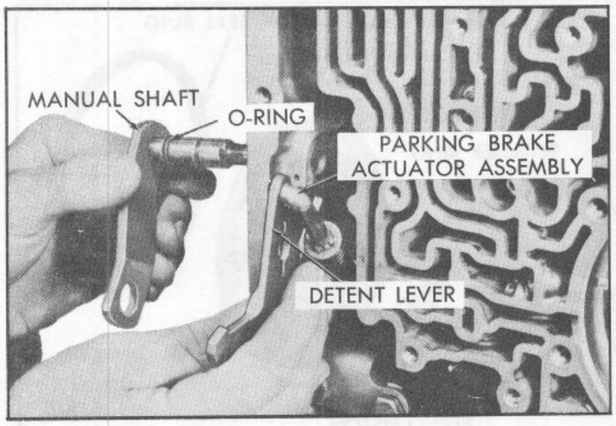


Fig. 7-199 Installing Manual Shaft

4. Install a new manual shaft O-ring seal on manual shaft.

5. Install the actuator rod plunger under the parking bracket and over the parking pawl and through hole in detent lever. Position detent lever in transmission case.

6. Install the manual shaft assembly through the retaining lock nut on manual shaft, Fig. 7-199.

7. Install manual shaft retaining pin into case, long smooth end first.

8. Torque lock nut to 18 ft. lbs.

c. Disassemble Rear Servo Assembly (Fig. 7-200)

1. Remove rear accumulator piston from rear servo piston.

2. Remove E-ring retaining rear servo piston to band apply pin.

3. Remove rear servo piston and seal from band apply pin.

4. Remove washer, spring and retainer.

d. Inspect Rear Servo

1. Check freeness of oil seal rings in accumulator piston grooves.

(NOTE: See Fig. 7-200. Do not remove the teflon oil seal rings from the rear accumulator piston, unless the oil seal rings require replacement.

If the teflon inner oil seal ring, (small diameter) requires replacement, for service, use the aluminum oil seal ring.

The rear accumulator piston, large diameter ring groove depth, is machined shallower to take the large teflon oil seal ring; if this requires replacement, use only the teflon oil seal ring.)

2. Inspect fit of band apply pin in servo piston.

3. Inspect band apply pin for scores or cracks.

4. Inspect band apply pin for proper size as determined by pin selection check (Note 74.)

e. Assemble Rear Servo

1. Install spring retainer, cup side first, servo pin spring and washer on servo pin.

2. Install servo piston on pin and secure with E-ring retainer.

3. If removed, install oil seal ring on servo piston.

4. If removed, install inner and outer oil rings on accumulator piston.

5. Install accumulator iston nto bore of servo piston.

f. Install Rear Servo

(NOTE: If transmission is in the vehicle, a sheet metal bracket will be required to hold the rear servo assembly, front servo assembly, check balls, valve body

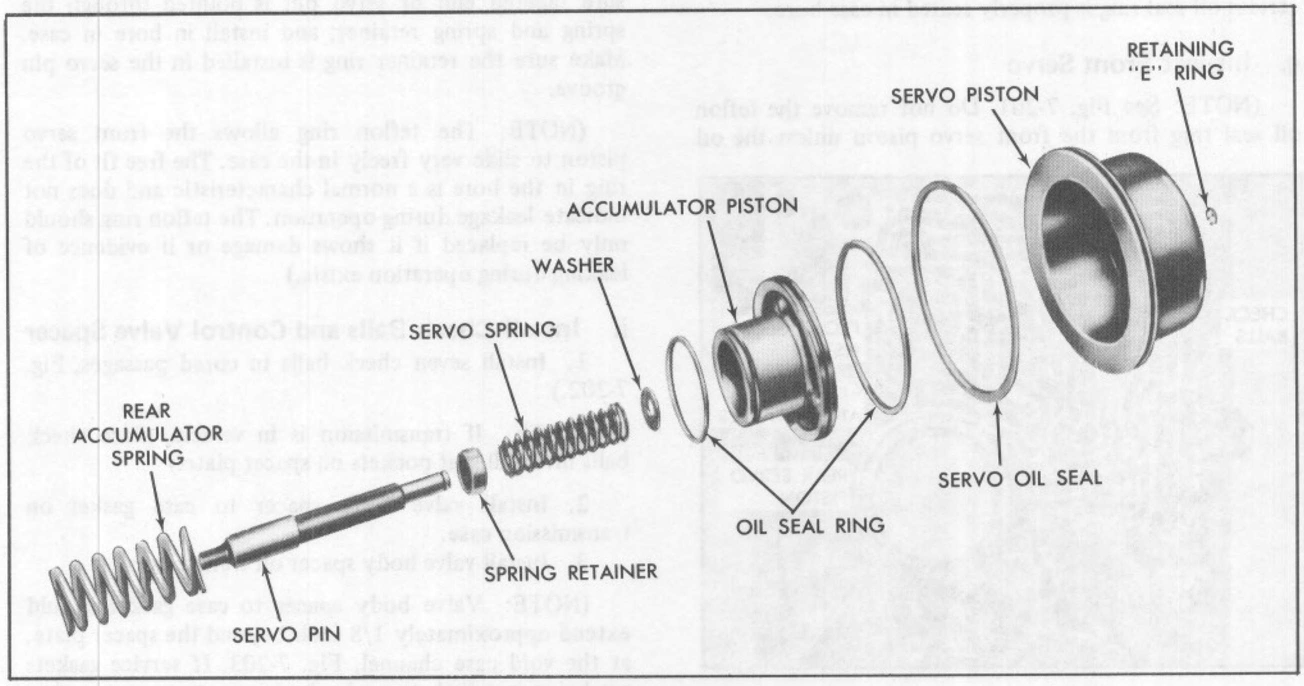


Fig. 7-200 Rear Servo and Accumulator—Exploded View

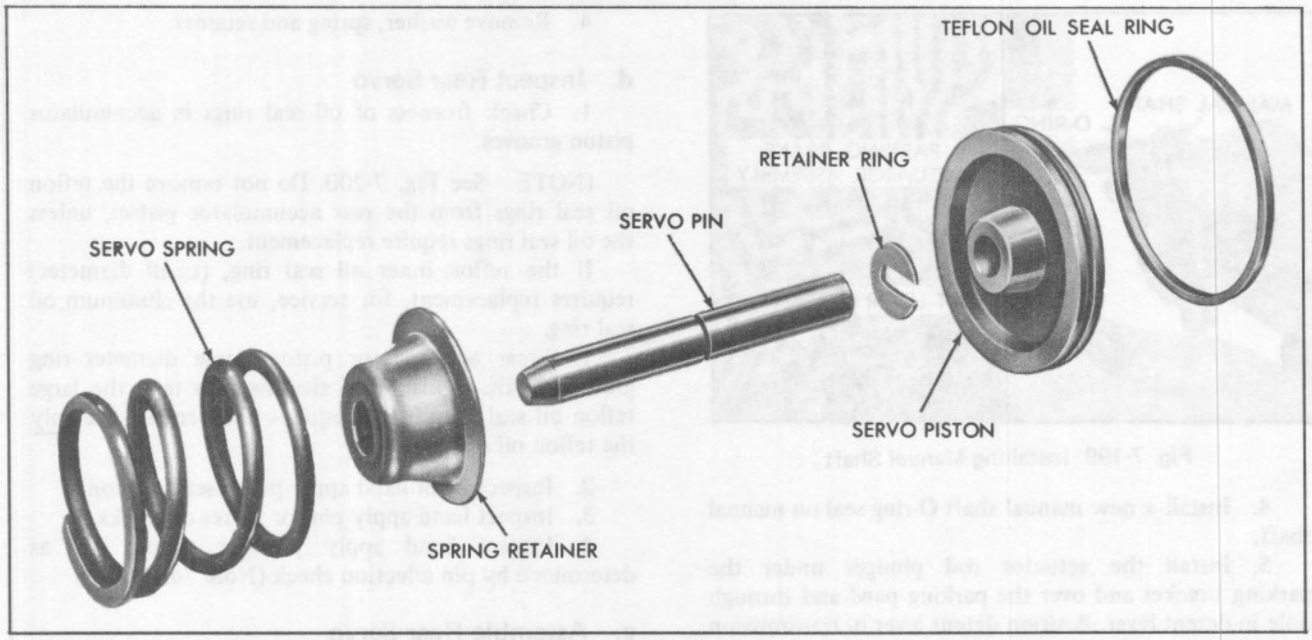


Fig. 7-201 Front Servo—Exploded View

to spacer plate gasket and valve body spacer plate, until the control valve assembly is installed. See Fig. 7-208.)

1. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and install rear accumulator spring in servo inner bore.

(NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin bore in transmission case. Otherwise servo pin will not apply band.)

2. Position rear servo assembly in transmission case bore.

3. Press down on rear servo assembly, making certain oil seal ring is properly seated in case bore.

g. Inspect Front Servo

(NOTE: See Fig. 7-201. Do not remove the teflon oil seal ring from the front servo piston unless the oil seal ring requires replacement. For service, the oil seal ring will be aluminum.)

CAUTION: The spring retainer, servo pin, retaining ring and servo piston for 1971 thru 1974 are not interchangeable with the pre-1971 parts.

1. Inspect servo pin for damage.
2. Inspect piston oil ring for damage.
3. Inspect piston for cracks or porosity.
4. Check fit of servo pin in piston and case.

h. Install Front Servo Assembly

Reassemble parts of front servo, Fig. 7-201, making sure tapered end of servo pin is pointed through the spring and spring retainer, and install in bore in case. Make sure the retainer ring is installed in the servo pin groove.

(NOTE: The teflon ring allows the front servo piston to slide very freely in the case. The free fit of the ring in the bore is a normal characteristic and does not indicate leakage during operation. The teflon ring should only be replaced if it shows damage or if evidence of leaking during operation exists.)

i. Install Check Balls and Control Valve Spacer

1. Install seven check balls in cored passages, Fig. 7-202.)

(NOTE: If transmission is in vehicle, place check balls into ball seat pockets on spacer plate.)

2. Install valve body spacer to case gasket on transmission case.

3. Install valve body spacer on transmission.

(NOTE: Valve body spacer to case gasket should extend approximately 1/8 inch beyond the spacer plate, at the void case channel, Fig. 7-203. If service gaskets are being installed, the valve body spacer to case gasket has an extension which will cover the void case channel.)

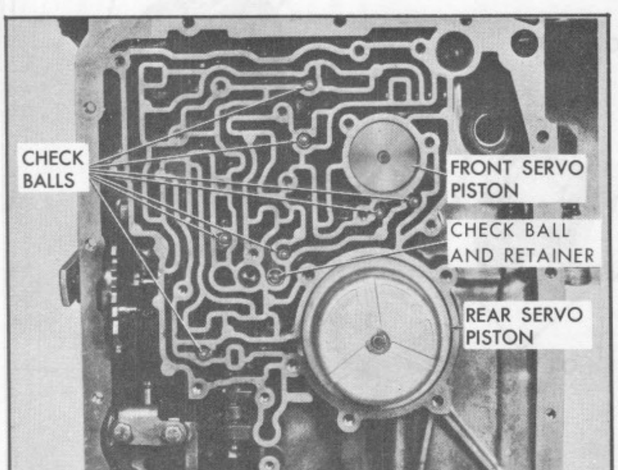


Fig. 7-202 Location of Check Balls

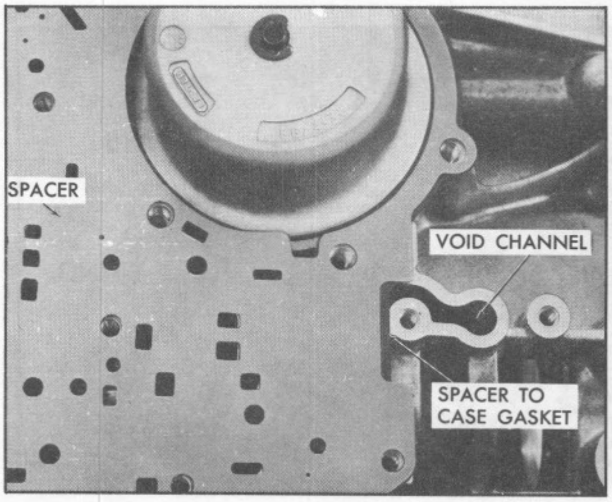


Fig. 7-203 Valve Body Spacer-to-Case Gasket

4. Install valve body to spacer gasket.
5. Install guide pins.

94. Control Valve Assembly (Fig. 7-211)

a. Disassembly

When disassembling control valve, make certain that springs are accurately identified so that they can be properly reassembled.

1. Position control valve assembly with gasket surface down.
2. Remove two screws securing detent solenoid to control valve body and remove detent solenoid and gasket.
3. Position control valve assembly with gasket surface up and accumulator pocket on bottom.
4. Remove manual valve from upper bore.
5. Install Control Valve Accumulator Piston Installer, J-21885, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-205.
6. Remove Installer, J-21885, and remove accumulator piston and spring.

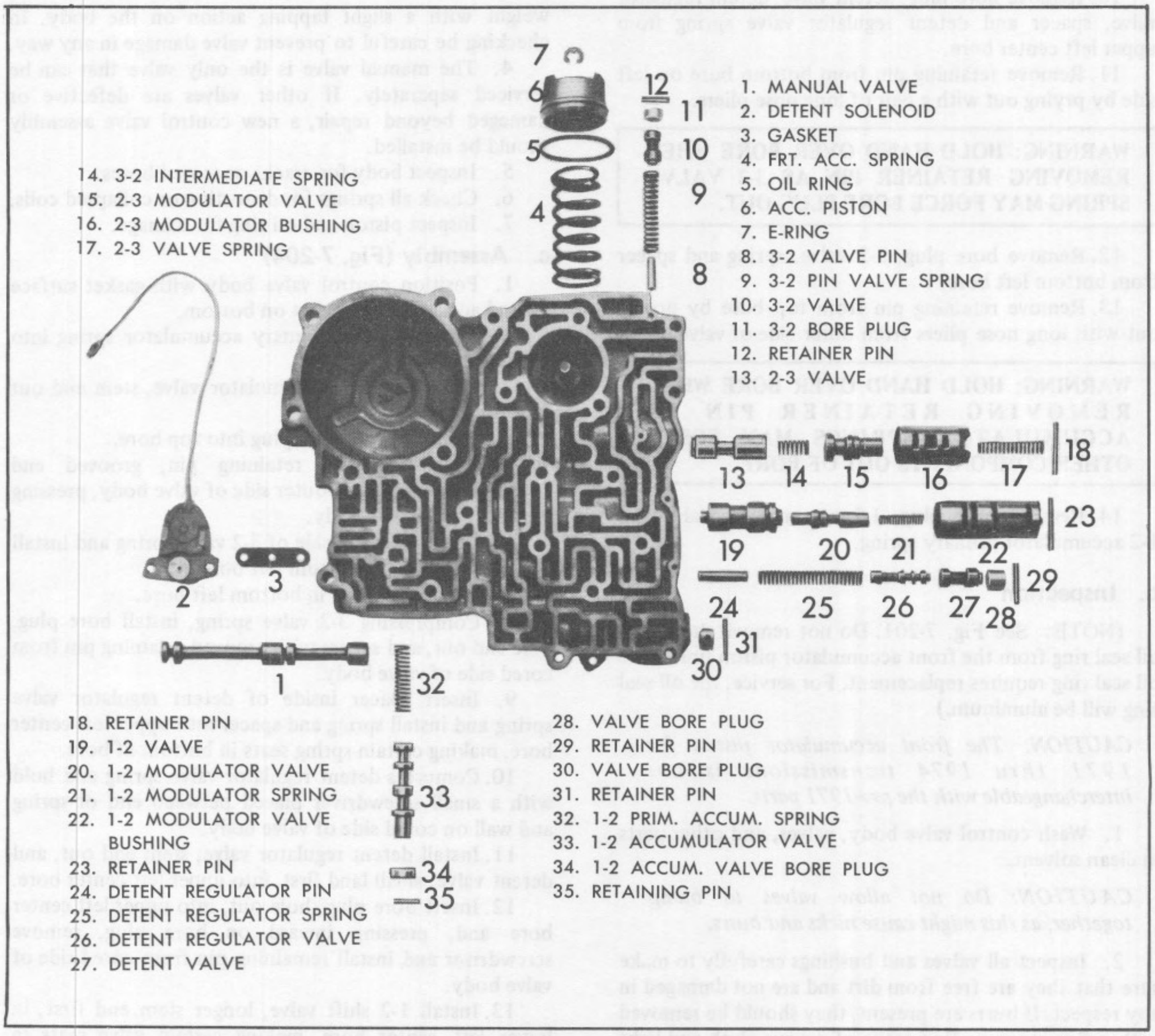


Fig. 7-204 Control Valve—Exploded View

7. Using pin punch, remove retaining pin from lower left bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring, 2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from lower left bore.

(NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.)

8. Using pin punch, remove retaining pin from lower center left bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 modulator spring, 1-2 modulator valve and 1-2 shift valve from lower left center bore.

9. Using pin punch, remove retainer pin from upper left center bore by pressing on outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS DETENT REGULATOR VALVE SPRING MAY FORCE OTHER COMPONENTS OUT OF BORE.

10. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left center bore.

11. Remove retaining pin from bottom bore on left side by prying out with a pair of long nose pliers.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS 3-2 VALVE SPRING MAY FORCE BORE PLUG OUT.

12. Remove bore plug, 3-2 valve, spring and spacer from bottom left bore.

13. Remove retaining pin from top bore by prying out with long nose pliers from outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS ACCUMULATOR SPRINGS MAY FORCE OTHER COMPONENTS OUT OF BORE.

14. Remove bore plug, 1-2 accumulator valve and 1-2 accumulator primary spring.

b. Inspection

(NOTE: See Fig. 7-201. Do not remove the teflon oil seal ring from the front accumulator piston unless the oil seal ring requires replacement. For service, the oil seal ring will be aluminum.)

CAUTION: The front accumulator piston for 1971 thru 1974 transmissions is not interchangeable with the pre-1971 parts.

1. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

2. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

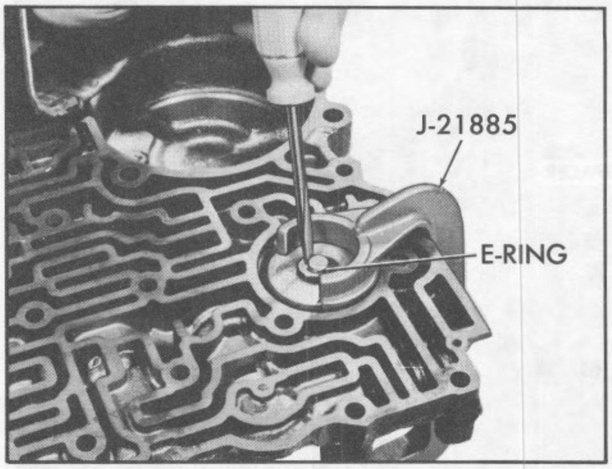


Fig. 7-205 Removing Front Accumulator

3. All valves and bushings should be tested in their individual bores to make certain that free movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking be careful to prevent valve damage in any way.

4. The manual valve is the only valve that can be serviced separately. If other valves are defective or damaged beyond repair, a new control valve assembly should be installed.

5. Inspect body for cracks or scored bores.

6. Check all springs for distortion or collapsed coils.

7. Inspect piston and oil ring for damage.

c. Assembly (Fig. 7-204)

1. Position control valve body with gasket surface up and accumulator pocket on bottom.

2. Install the 1-2 primary accumulator spring into top bore.

3. Install the 1-2 accumulator valve, stem end out into top bore.

4. Install the 1-2 bore plug into top bore.

5. Install grooved retaining pin, grooved end entering hole last from outer side of valve body, pressing pin flush with valve body.

6. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom left bore.

7. Install 3-2 valve in bottom left bore.

8. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with grooved retaining pin from cored side of valve body.

9. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left center bore, making certain spring seats in bottom of bore.

10. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.

11. Install detent regulator valve, stem end out, and detent valve, small land first, into upper left center bore.

12. Insert bore plug, hole out, into upper left center bore and, pressing inward on bore plug, remove screwdriver and install remaining pin from cored side of valve body.

13. Install 1-2 shift valve, longer stem end first, in lower left center bore, making certain valve seats in bottom of bore.

14. Install 1-2 modulator spring into 1-2 modulator valve and install, hole end first, into 1-2 modulator bushing. Install assembly into lower left center bore of control valve body, open end of bushing first.

15. Compress bushing against spring and secure with retaining pin from cored side of control valve body.

16. Install 3-2 intermediate spring in open end of 2-3 shift valve and install valve and spring, valve first, into lower left bore. Make certain valve seats in bottom of bore.

17. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in lower left bore.

18. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.

19. Position front accumulator spring and piston into valve body and install Control Valve Accumulator Piston Installer, J-21885, on piston. Compress spring and piston, aligning spring and piston with bore, Fig. 7-205.

CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

20. Secure piston and spring with E-ring retainer and remove Installer, J-21885.

21. Install manual valve into top bore.

22. Placing control valve assembly on gasket surface, position detent solenoid gasket and detent solenoid on valve body.

23. Install downshift solenoid attaching screws.

24. Install governor drive pipe into control valve body in bore by rear servo cover.

25. Install two governor screen assemblies with open end up, Fig. 7-206.

d. Install Control Valve Assembly

1. Using two guide pins, Fig. 7-207, install control valve assembly and governor pipe on transmission. Make certain gaskets and spacer do not become mispositioned.

(NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipe to make certain it is properly seated in case hole.)

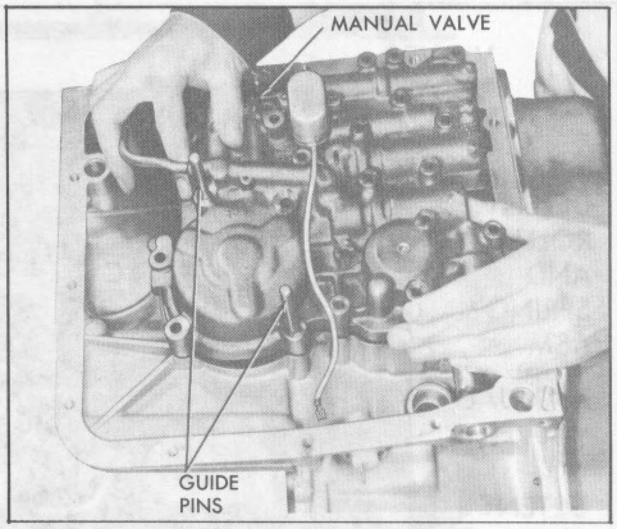


Fig. 7-207 Installing Control Valve Assembly

2. Remove guide pins and install control valve assembly attaching screws, eliminating detent roller and spring assembly attaching screw. Torque bolts to 8 foot-pounds, Fig. 7-209.

3. Install detent roller and spring assembly and attaching screw. Tighten screw to 8 foot-pounds.

4. Install detent solenoid wire to electrical connector.

5. Install governor feed pipe in transmission case and control valve body.

(NOTE: Make certain that governor feed pipe is seated in bores in case and valve body.)

95. Pressure Regulator Valve, Intake Pipe and Filter Assembly, Bottom Pan, Modulator Valve and Modulator

a. Install Pressure Regulator Valve

1. Install spring retainer on pressure regulator

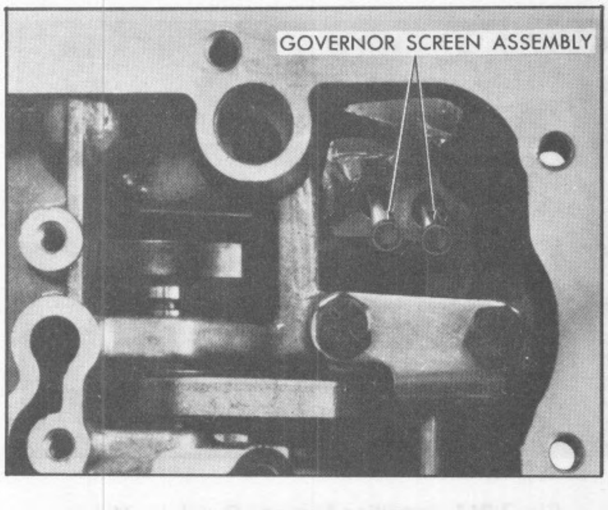


Fig. 7-206 Installing Governor Screens

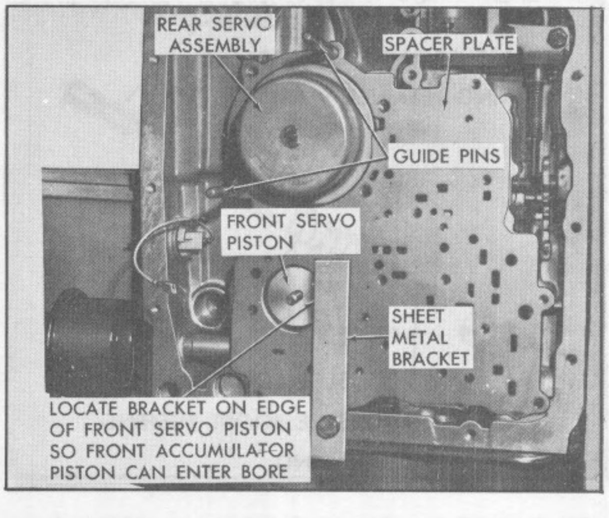


Fig. 7-208 Installing Control Valve Assembly—(on Car)

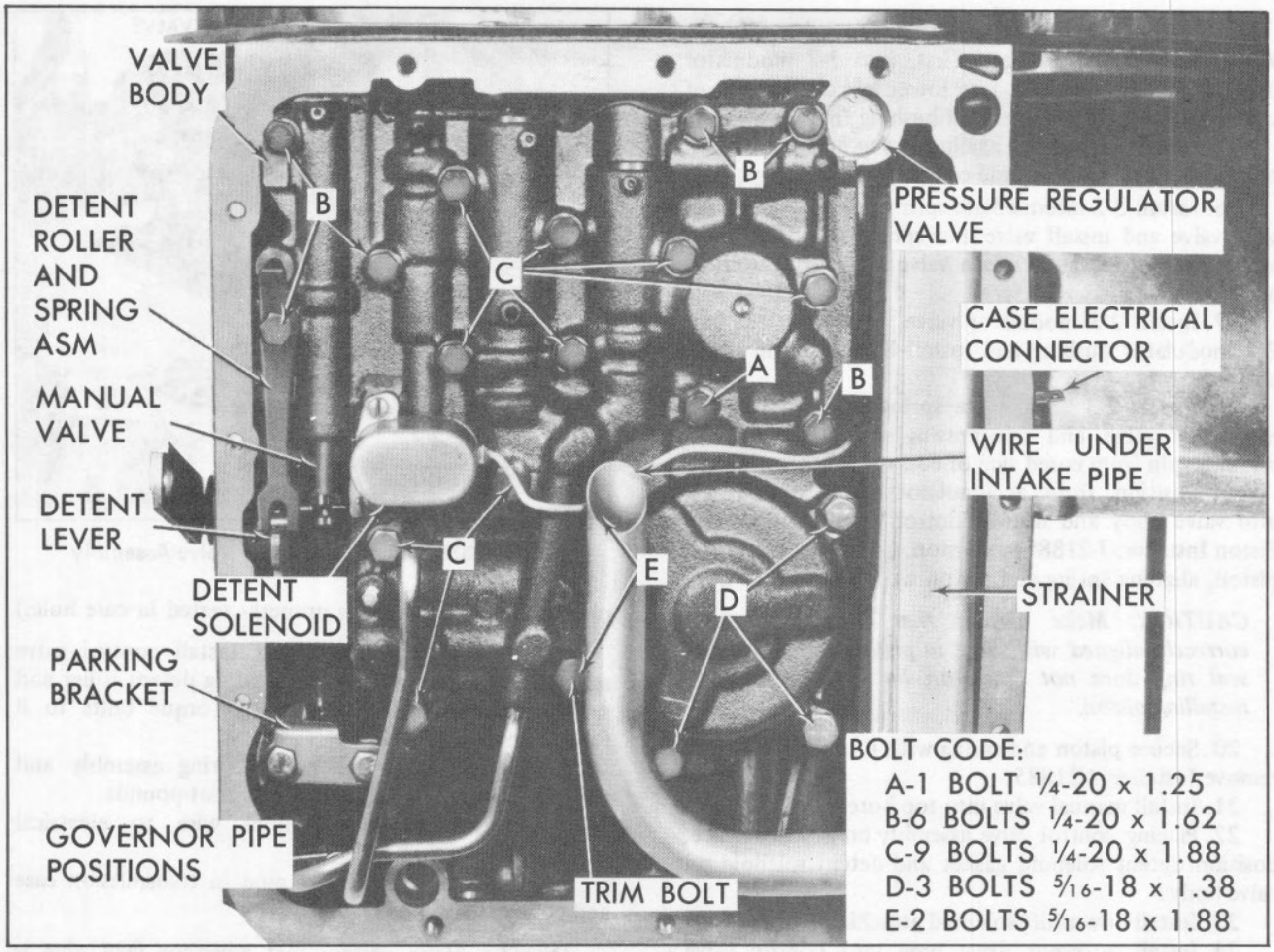


Fig. 7-209 Control Valve Assembly Screws

spring. Also install spacers if previously removed, Fig. 7-210.

2. Install pressure regulator valve on spring, stem end first.

3. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.

4. Install complete assembly, pressure regulator valve first, into pressure regulator valve bore, being careful not to drop parts during installation.

5. Using a screwdriver or steel rod, compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-211.

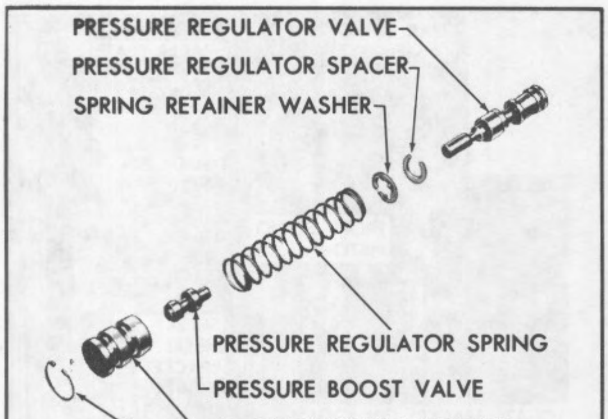


Fig. 7-210 Pressure Regulator Valve–Exploded View

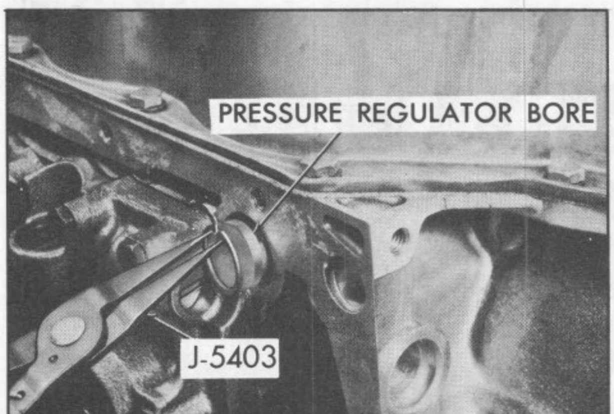


Fig. 7-211 Installing Pressure Regulator Valve

(NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring into ring groove in valve bore.)

b. Install Intake Pipe and Filter Assembly and Bottom Pan

1. Install new intake pipe O-ring into pipe bore in transmission case and install intake pipe and filter assembly.
2. Install new bottom pan gasket on transmission case and install bottom pan.
3. Install 13 bottom pan attaching screws. Tighten screws to 12 foot-pounds.

c. Inspect Vacuum Modulator and Valve

1. Inspect vacuum modulator for any signs of bending or distortion.
2. Inspect O-ring seat for damage.
3. Inspect modulator valve for nicks or damage.
4. Check freeness of valve operation in case bore.
5. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure. Use procedure outlined in Diagnosis Part V.

d. Install Modulator Valve and Vacuum Modulator

1. Install modulator valve into case with stem end out.
2. Install new O-ring on vacuum modulator.
3. Install vacuum modulator into case with vacuum hose pipe facing case connector.
4. Install modulator retainer with curved side of tangs inboard and install attaching screw. Tighten screw to 18 foot-pounds.

96. Governor Assembly

(NOTE: All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is factory calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.)

a. Governor Inspection

1. Wash in cleaning solvent, and blow out all passages.
2. Inspect governor sleeve for nicks, burrs, scoring or galling.
3. Check governor sleeve for free operation in bore of transmission case.
4. Check governor valve for free operation in bore of governor sleeve.
5. Inspect governor driven gear for nicks, burrs, or damage.
6. Check governor driven gear for looseness in governor sleeve.
7. Inspect speedometer drive gear for nicks, burrs, or damage.
8. Check speedometer drive gear for looseness on governor sleeve.
9. Inspect governor springs for distortion or damage.
10. Check governor weights for free operation in their retainers.
11. Check valve opening at entry and exhaust (.020" minimum).

b. Governor Driven Gear Replacement

To facilitate governor repair in the field, governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Place governor sleeve on a block of wood and drive retaining pin out, using a small punch or 1/8" drill rod.
2. Remove governor driven gear as follows:
   a. Insert governor driven gear in a vice.
   b. Firmly grip governor sleeve with hands and twisting and pulling at the same time, pull governor sleeve away from the governor driven gear.
   c. Discard governor driven gear.
3. Remove governor valve and wash all parts in cleaning solvent and blow off parts.
4. Install governor valve, end with holes last, into governor sleeve.
5. Support governor on 7/64" plates, installed in exhaust slots of sleeve, position new gear in sleeve and with a 7/16" socket, press gear into sleeve until seated. See Fig. 7-212.
6. Place governor sleeve on a block of wood and with a 1/8" drill, drill half way through each side of gear; drill through existing hole. See Fig. 7-213.
7. Install split retaining pin, making sure each end is slightly below top of hole.

CAUTION: Extreme care must be taken to prevent damaging the parts.

8. Stake both ends of pin hole, two places.
9. Thoroughly wash governor assembly in cleaning solvent and blow out all passages.

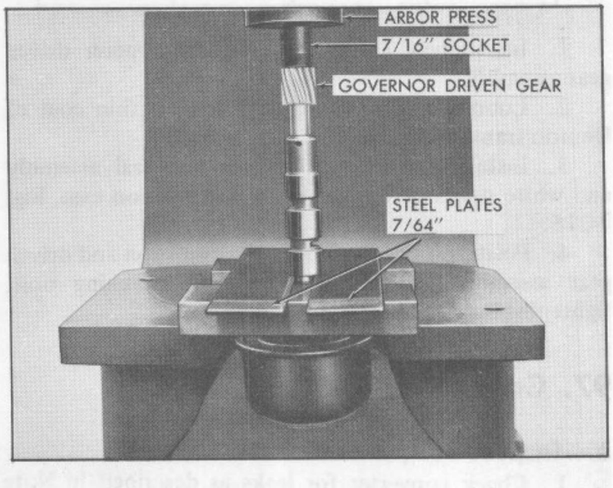


Fig. 7-212 Installing Governor Gear in Sleeve

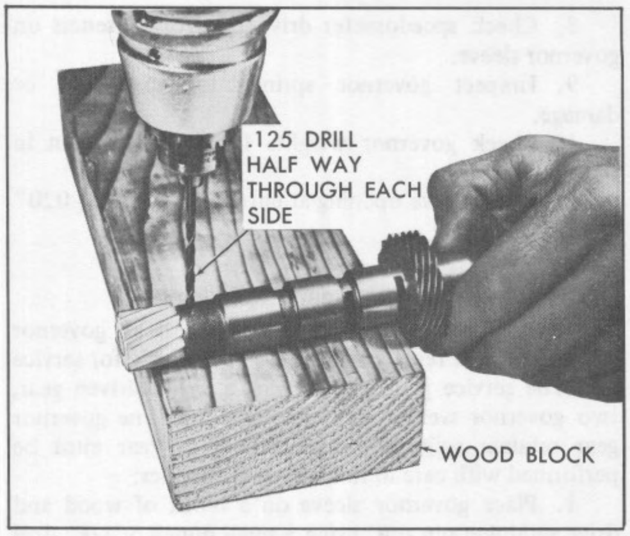


Fig. 7-213 Drilling into Side of Gear

c. Install Governor

1. Rotate transmission in Holding Fixture Base so that governor bore is up.
2. Install new square cut O-ring seal on governor assembly and install assembly into transmission case, Fig. 7-214.
3. Position retaining clip on top of governor assembly.

d. Inspect Speedometer Driven Gear Assembly

1. Inspect gear for damaged teeth or shaft.
2. Inspect sleeve for scores, damaged threads or cracks.

e. Install Speedometer Driven Gear

Rear Axle Ratio	Driven Gear Teeth	Drive Worm Gear Teeth	Color of Driven Gear
3.07:1	31	14	White
2.73:1	27	14	Black

1. Install new O-ring seal on speedometer driven gear assembly.
2. Lubricate housing lip seal with a thin coat of Dexron transmission fluid.
3. Install speedometer housing and seal assembly and white nylon driven gear into transmission case, Fig. 7-215.
4. Position retaining clip to transmission and driven gear assembly and secure with one attaching bolt, tightening bolt to 6 ft. lbs.

97. Converter

a. Inspect Torque Converter

1. Check converter for leaks as described in Note 13.

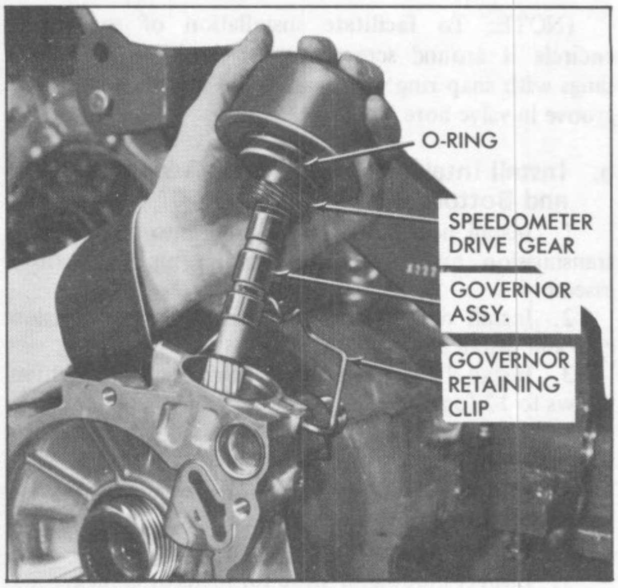


Fig. 7-214 Installing Governor Assembly

2. Check converter hub surfaces for signs of scoring or wear.

b. Install Torque Converter

1. Position transmission jack with adapter plate to transmission and install transmission on jack using brace and safety chain.
2. Carefully position converter on turbine shaft, making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.
3. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.
4. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.
5. Install Converter Holding Clamp, J-21366, on transmission case.
6. Remove Transmission Holding Fixture, J-22240, from transmission.

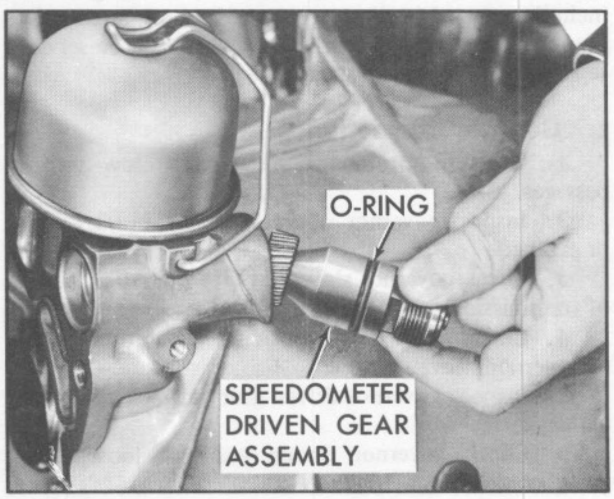


Fig. 7-215 Installing Speedometer Driven Gear

TORQUE CHART

Material Number	Application	Thread Size	Foot Pounds
280M	Transmission to Engine Screws	3/8–16	35
300M	Torque Converter to Flywheel Screws	3/8–16	30
1010	Flywheel Housing Cover to Transmission Screws	1/4–20	5
300M	Final Drive to Transmission Screws	3/8–16	25
280M	Solenoid to Case Screw	1/4–20	10
Special	Line Pressure Plug	1/8 Pipe	10
260M	Vacuum Modulator Retainer	5/16–18	18
260M	Control Valve Body to Case Screw	1/4–20	8
300M	Center Support to Case	3/8–16	23
286M	Manual Shaft to Inside Lever	3/8–24	18
280M	Pump Body to Cover Plate	5/16–18	20
280M	Parking Brake Bracket to Case	5/16–18	18
1010–1020	Oil Pan to Case Screw	5/16–18	12
280M	Sprocket Housing Screw	1/4–20	8
260M	Support Housing to Cover Plate	5/16–18	20
260M	Speedometer Driven Gear Retainer to Case	5/16–18	18
280M	Rear Engine Mount to Transmission Bracket	3/8–16	25
280M	Support Bracket to Transmission.		55
275M	Rear Engine Mount to Frame		25

SPECIAL TOOLS

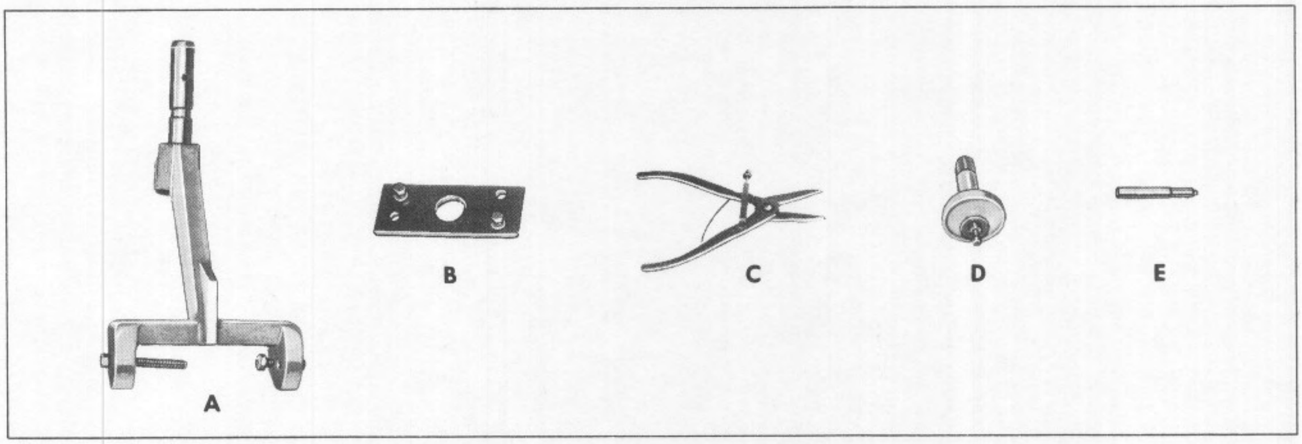


Fig. 7-216 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22240	Transmission Holding Fixture	C	J-4646	Snap Ring Pliers
B	J-21370-8	Band Apply Adapter Plate	D	J-22241	Front Unit End Play Checking Tool
			E	J-21370-7	Band Apply Adapter Pin

(NOTE: The above Special Tools are required in addition to most tools shown in Fig. 7-114 to properly overhaul the Turbo Hydra-matic transmission used on the Eldorado.)

FUEL SYSTEM

GENERAL DESCRIPTION

The fuel tank is mounted at the rear of the car under the trunk compartment with two support straps.

The fuel tank capacity is approximately 27-1/2 U.S. gallons (23 Imperial gallons) on all models.

All Cadillac vehicles are equipped with a system to prevent evaporation of fuel from the tank. Complete information on this system is found in Section 6.

The gasoline filler cap is located behind the rear license mounting plate, which is the filler door. The hinged plate swings out from the bottom. The filler pipe is an integral part of the fuel tank on all cars except Commercial Chassis.

The filler cap is a pressure-vacuum (PV) type on all models. For a complete description of the fuel tank vent system, refer to Emission Control Systems, Section 6.

The tank unit for the gasoline gage is mounted near the top center of the fuel tank. It contains the float unit, which is connected to the gage unit on the instrument panel by one wire, with another wire to ground. The fuel outlet line is integral with the tank float unit assembly. It has a special plastic filter (water separator) on the inlet end. The filter has a self-cleaning action, provided by the sloshing action of the gasoline.

The fuel outlet line is attached to the gage assembly on the top center of the tank and extends along the inside of the left frame side rail to the fuel pump, Fig. 8-1.

SERVICE INFORMATION—FUEL SYSTEM

1. Storage Precautions

Whenever a car is to be put in storage for 30 days or longer, all gasoline should be removed from the fuel tank. Disconnect all fuel lines, blow out and reconnect. Remove carburetor, clean thoroughly and store in plastic bag. Remove fuel pump, clean and store with carburetor. Remove filter assembly and discard. Tape all openings closed. This must be done to assure freedom from gum deposits that would occur due to evaporation of the fuel.

WARNING: THE FOLLOWING PROCEDURES SHOULD BE ADHERED TO WHEN DRAINING AND REMOVING A FUEL TANK:

- **BE SURE TO DISCONNECT BATTERY CABLES BEFORE DRAINING.**
- **PLACE "NO SMOKING" SIGNS AND A CO_2 FIRE EXTINGUISHER AT WORK AREA. WEAR SAFETY GLASSES AND SIPHON INTO A SUITABLE EXPLOSIVE PROOF CONTAINER.**

2. Fuel Tank

a. Removal

1. Disconnect battery, open fuel tank filler door and disconnect sending unit (tan) feed wire.
2. Drain fuel from tank by siphoning as described in Note 5.
3. Raise car.
4. Remove screw securing ground wire to cross member.
5. Disconnect fuel line and evaporative loss control system lines at front of tank. If car is equipped with air conditioning, remove vapor return line. Plug all disconnected lines.
6. Support tank with jack and wood block and remove one screw, each side, securing fuel tank support straps to body at front of tank.
7. Lower jack with fuel tank and remove tank.

b. Installation

1. Position tank to underbody; position fuel tank support straps under tank and loosely install screws securing straps to body.
2. Secure ground wire to rear cross member.
3. Tighten tank strap screws until bottomed. Torque to 25 ft. lbs.
4. Connect fuel lines and evaporative loss control system lines. If car is equipped with air conditioning, connect vapor return line.
5. Lower car.
6. With fuel filler door open, connect sending unit (tan) feed wire.
7. Replace drained fuel in tank.

3. Fuel Tank Strap

a. Removal

1. Raise car and support tank.
2. Remove screw securing strap to body at front of tank.
3. Remove torx screw securing strap to body at rear of tank using Tool J-24392 or No. 30 torx bit.
4. Remove strap.

b. Installation

1. Install strap in hanger at rear of tank.
2. Secure strap to body with one torx screw using Tool J-24392 or No. 30 torx bit.
3. Secure other end of strap to body at front of tank with one screw.
4. Lower car.

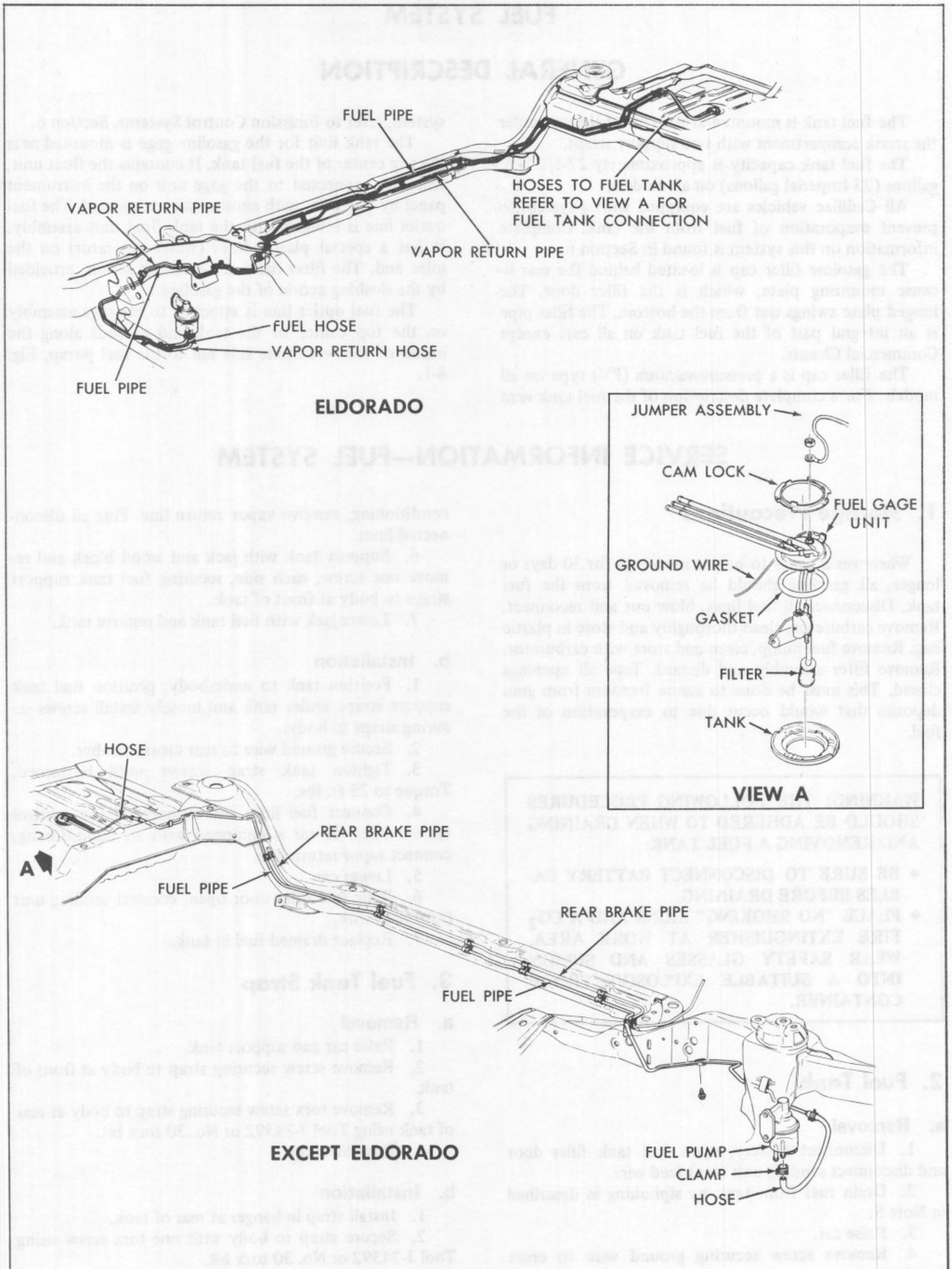


Fig. 8-1 Fuel Lines and Tank

4. Fuel Line and Tank Cleaning

Occasionally it may be necessary to clean out fuel line and tank to remove foreign particles from system. Frequent replacement of fuel filters and excessive deposits of dirt in the fuel inlet strainer are indications that this may be necessary.

a. Fuel Line

To clean out fuel line, disconnect line at fuel pump and at fuel tank, blow compressed air through the line in direction opposite to fuel flow, and reconnect line.

b. Fuel Tank

For cleaning fuel tank, tank must be removed from car and flushed out to remove all foreign materials. Fuel strainer also should be inspected and replaced if necessary.

(NOTE: If trouble is due to contaminated fuel or foreign material that has been put into the tank, it can usually be cleaned. If tank is rusted internally, it should be replaced.)

1. Disconnect battery and ignition coil primary wire (plus wire on ignition coil).

CAUTION: Make sure ignition coil primary wire (+ terminal) is disconnected to prevent open spark.

2. Drain fuel tank by siphoning as described in Note 5.
3. Remove fuel tank as described in Note 2a.
4. Locate tank away from heat, flame, or other source of ignition. Remove fuel gage unit from tank using Tool J-24187, and inspect condition of filter. If filter is contaminated, a new filter should be installed upon reassembly.
5. Complete draining of tank by rocking it and allowing fuel to run out tank unit hole.
6. Purge fuel tank with steam or running hot water for at least five minutes. Pour water out of tank unit hole (rock tank to assure complete removal of water).

(NOTE: This procedure will not remove fuel vapor. Do not attempt any repair on tank or filler neck where heat or flame is required.)

7. Disconnect inlet fuel line at pump and use air pressure to clean fuel line and vapor return line (if equipped). Apply air pressure through line in the direction opposite to normal fuel flow.
8. Use low air pressure to clean pipes on tank unit.
9. Install new filter on fuel gage unit, if required. Using Tool J-24187, install fuel gage unit with new gasket into tank and install tank as described in Note 2b. Connect tank unit wires and all fuel lines.
10. Disconnect fuel line at carburetor, connect a hose to fuel line and insert other end of hose into a one gallon fuel can.
11. Connect battery cable. Make sure ignition coil primary wire is disconnected.
12. Put six gallons of clean fuel in tank and operate starter to pump two quarts of fuel into fuel can. This will purge fuel pump.

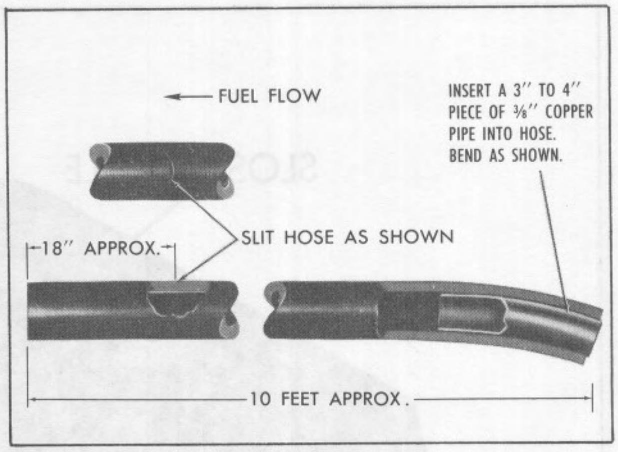


Fig. 8-2 Fuel Drain Hose

13. Remove hose and connect fuel line to carburetor.
14. Connect coil primary wire.

5. Draining Fuel Tank

1. Using approximately 10 feet of 3/8" I.D. Hose, cut a slit 18" from one end. Make the slit towards the short end. (Fig. 8-2)
2. Insert a 4" piece of 3/8" copper line into the opposite end of the hose.
3. Insert the copper line end of the hose into the tank with natural curl of hose pointed down until the end rests on the bottom of the tank.

(NOTE: Difficulty may be experienced inserting the hose through the holes in the tank baffle. By turning the hose from side to side, continue inserting the hose through the baffle to the bottom of the tank. (Fig. 8-3))

(NOTE: Tank can be siphoned more rapidly by raising the car one foot higher in the rear than the front.)

4. Insert an air hose into the slit. A short blast of air will cause the fuel to flow.

6. Fuel Tank Float Unit

a. Removal

1. Remove fuel tank as described in Note 2.
2. Remove locknut securing fuel gage tank unit and remove wire from tank unit.
3. Install Fuel Tank Sending Unit Remover and Installer, J-24187, on cam locking ring so that tool engages three tabs on ring, Fig. 8-4.
4. Install ratchet and turn counterclockwise to disengage locking ring from fuel tank. Remove tool and lift unit from tank.

b. Installation

1. Install gage tank unit in fuel tank, using new gasket.
2. Install Fuel Tank Sending Unit Remover and Installer, J-24187, engaging three tabs on cam locking ring.

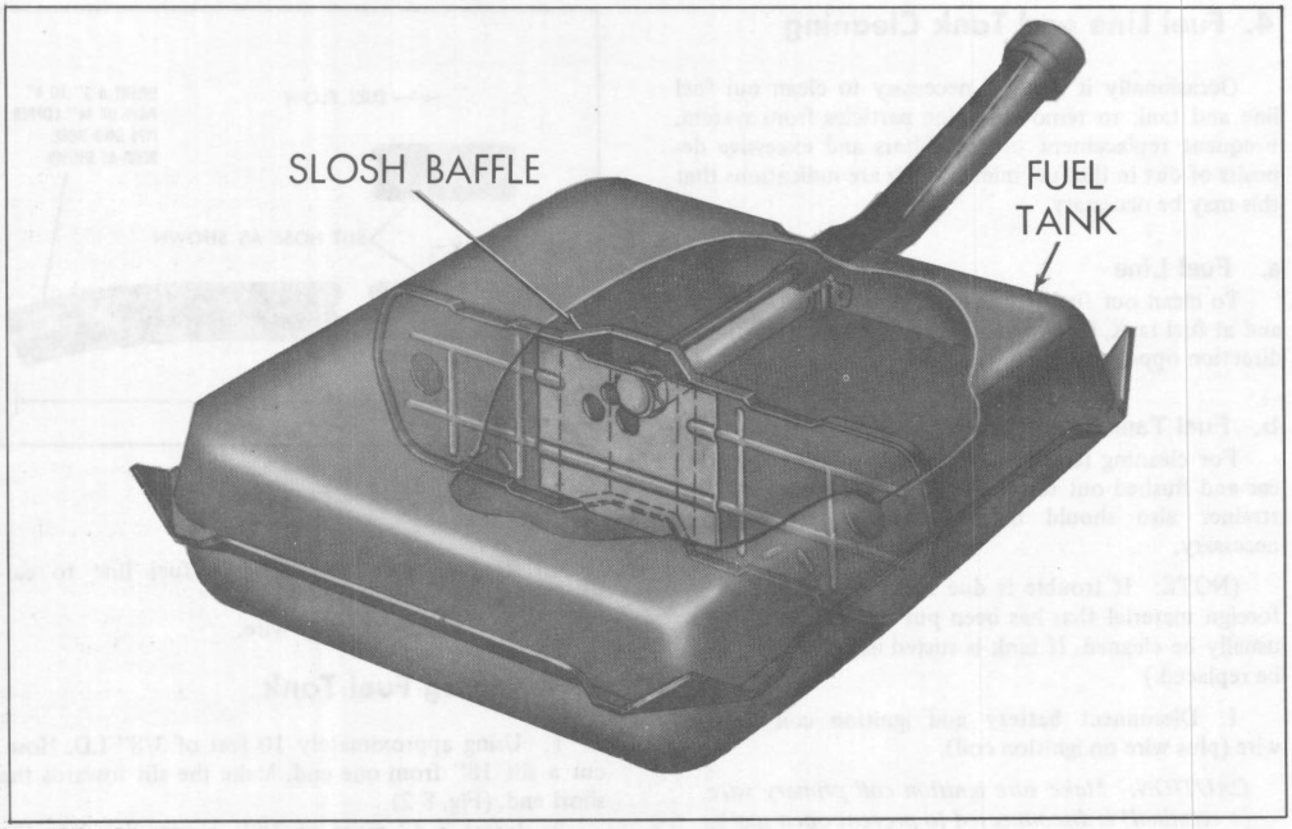


Fig. 8-3 Fuel Tank

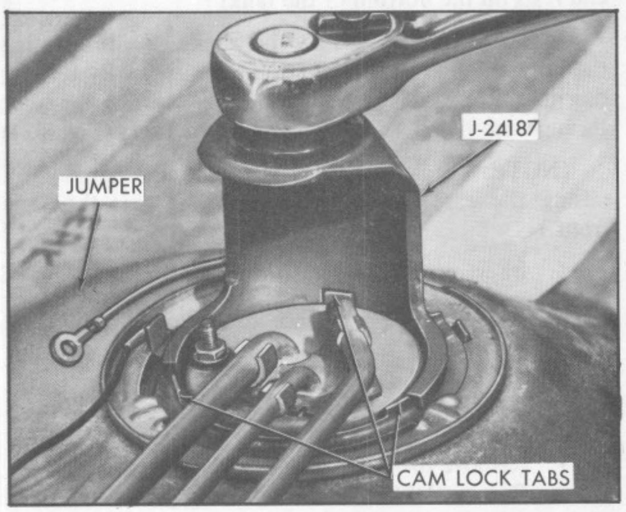


Fig. 8-4 Removing & Installing Fuel Tank Sending Unit

3. Turn locking ring clockwise until ring is fully engaged in fuel tank, then remove tool.

4. Connect fuel gage wire to gage tank unit and secure with attaching locknut.

5. Install fuel tank as described in Note 2.

7. Fuel Line

a. Removal

1. Raise car.

2. Remove clamps securing flexible fuel line to fuel tank outlet and to fuel pump and disconnect lines at these points.

3. Tie a five foot length of cord to the flexible fuel lines for installation purposes. (Cord will be used to pull lines during installation and are left with car after lines are removed.)

4. Plug hoses to prevent fuel loss.

5. Remove clips securing fuel line to right frame side rail.

6. Carefully remove fuel lines from car, leaving cord in place on car.

7. Remove clamps securing flexible fuel line to fuel pipe and separate.

b. Installation

1. Connect flexible fuel line to steel fuel pipe and secure with clamps. Hoses should overlap steel line one inch.

2. Position fuel pipe to surface of right frame side rail and secure with clips.

3. Tie cords left in car to ends of flexible lines and carefully pull fuel lines to tank and engine.

4. Remove cords.

5. Unplug lines.

6. Connect flexible lines at tank and engine and secure with clamps.

7. Lower car.

EXHAUST SYSTEM

GENERAL INFORMATION

(NOTE: Service information pertaining only to those features that are exclusive to the Eldorado exhaust system is included at the end of this section.

a. Exhaust System Design

The exhaust system on all Cadillac cars, except the Eldorado incorporates (in order from front to rear), a crossover Y-exhaust pipe, an intermediate pipe, a muffler and a muffler-to-resonator pipe with integral resonator, Fig. 8-5. On the Sixty Special Brougham, Fleetwood Seventy-Five, and Commercial Chassis, a longer intermediate pipe is used because of the additional length of these vehicles. Early cars except commercial chassis, have a rear exhaust deflector.

The components of the exhaust system are supported by slide and blade-type hangers, clamps, and brackets, and are insulated at attaching points by rubber cushions. These supports are designed to keep the system in proper alignment to avoid contact with the frame and body, even when the system is hot and expanded. The system must not be bound up or restricted if the noise reduction benefits are to be fully realized.

b. Exhaust System Service

Whenever a change is noticed in the sound of the exhaust system, or when exhaust gas can be detected inside the vehicle, inspect the complete exhaust system for broken or damaged parts, deterioration, broken seams or loose connections which may cause leaks. In addition, inspection for these conditions should be performed every 4 months, never to exceed 6,000 miles.

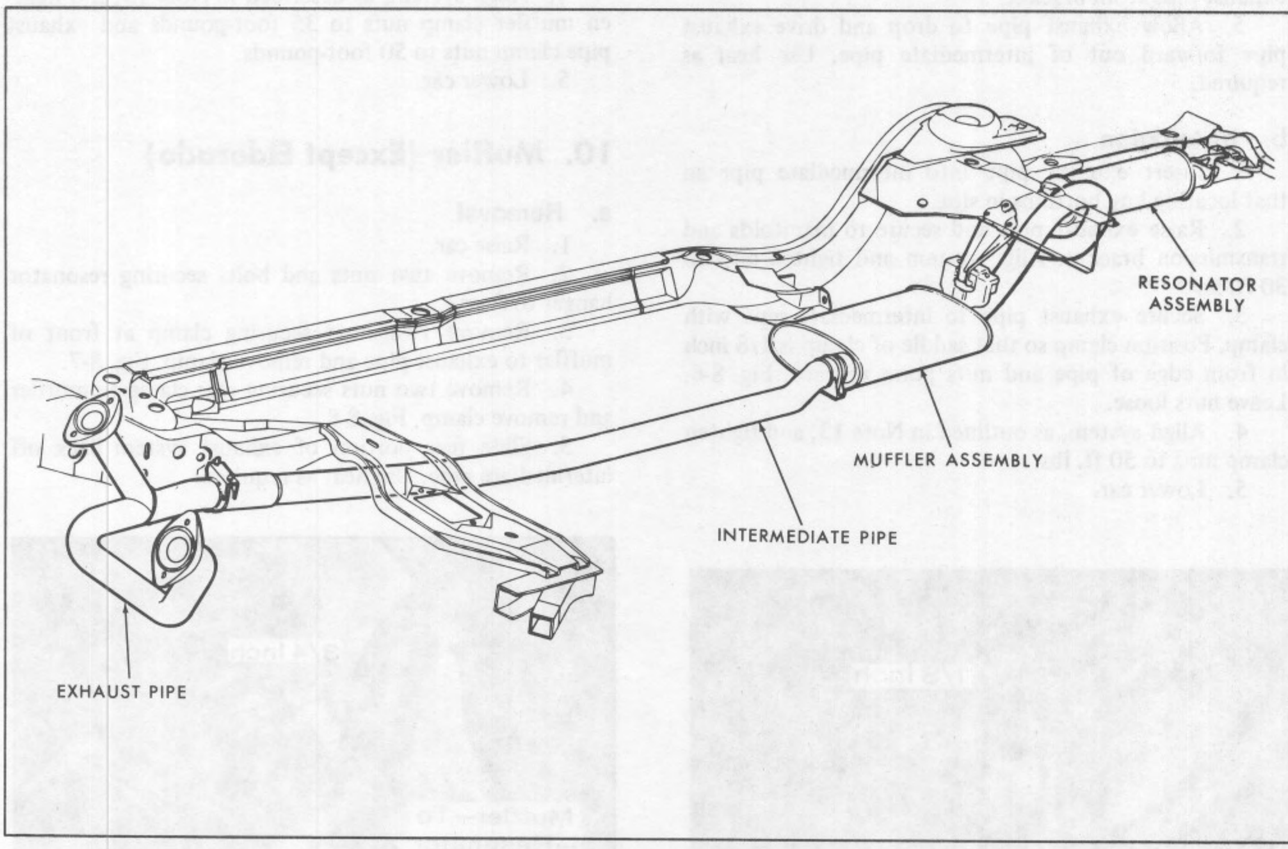


Fig. 8-5 Exhaust System—Except Eldorado

SERVICE INFORMATION—EXHAUST SYSTEM

8. Exhaust Pipe (Except Eldorado)

a. Removal

1. Raise car.

2. Remove two nuts securing pipes to each exhaust manifold.

3. Remove clamp securing exhaust pipe to intermediate pipe.

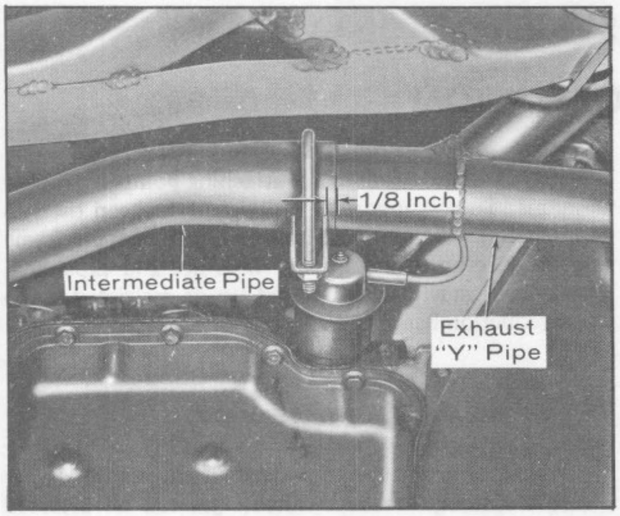


Fig. 8-6 Intermediate Pipe at Exhaust Pipe

4. Loosen bolt at transmission bracket and release exhaust pipe from bracket.

5. Allow exhaust pipe to drop and drive exhaust pipe forward out of intermediate pipe. Use heat as required.

b. Installation

1. Insert exhaust pipe into intermediate pipe so that locating key bottoms in slot.

2. Raise exhaust pipe and secure to manifolds and transmission bracket. Align system and tighten nuts to 30 ft.-lbs.

3. Secure exhaust pipe to intermediate pipe with clamp. Position clamp so that saddle of clamp is 1/8 inch in from edge of pipe and nuts point upward, Fig. 8-6. Leave nuts loose.

4. Align system, as outlined in Note 13, and tighten clamp nuts to 50 ft. lbs.

5. Lower car.

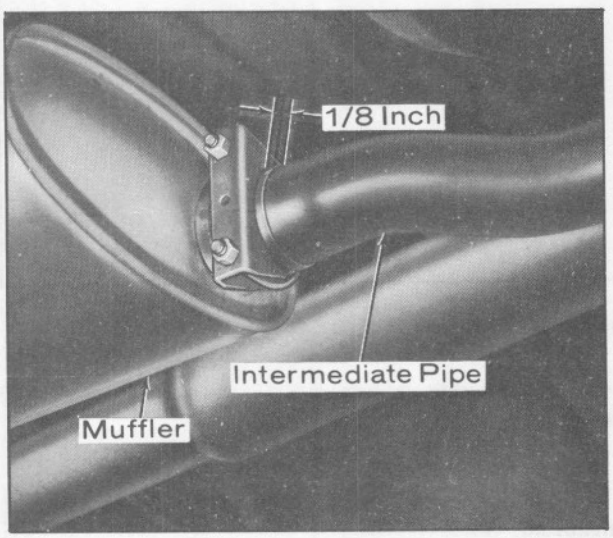


Fig. 8-7 Intermediate Pipe at Muffler

9. Intermediate Pipe (Except Eldorado)

a. Removal

1. Raise car.

2. Remove clamp securing muffler to intermediate pipe.

3. Slide muffler off intermediate pipe. Use heat as required.

4. Remove clamp securing intermediate pipe to exhaust pipe.

b. Installation

1. Slide intermediate pipe over exhaust pipe so that locating key bottoms in slot.

2. Secure intermediate pipe to exhaust pipe with clamp. Position clamp with saddle of clamp 1/8 inch from end of pipe and leave nuts loose.

3. Insert intermediate pipe into muffler approximately 1-1/2 inches. Position clamp with saddle of clamp 1/8 inch in from edge of pipe toward left side of car, Fig. 8-7.

4. Align system, as described in Note 13, and tighten muffler clamp nuts to 35 foot-pounds and exhaust pipe clamp nuts to 50 foot-pounds.

5. Lower car.

10. Muffler (Except Eldorado)

a. Removal

1. Raise car.

2. Remove two nuts and bolts securing resonator hanger to frame.

3. Remove two nuts securing clamp at front of muffler to exhaust pipe and remove clamp, Fig. 8-7.

4. Remove two nuts securing rear clamp to muffler and remove clamp, Fig. 8-8.

5. Slide rear portion of exhaust system back off intermediate pipe. Use heat as required.

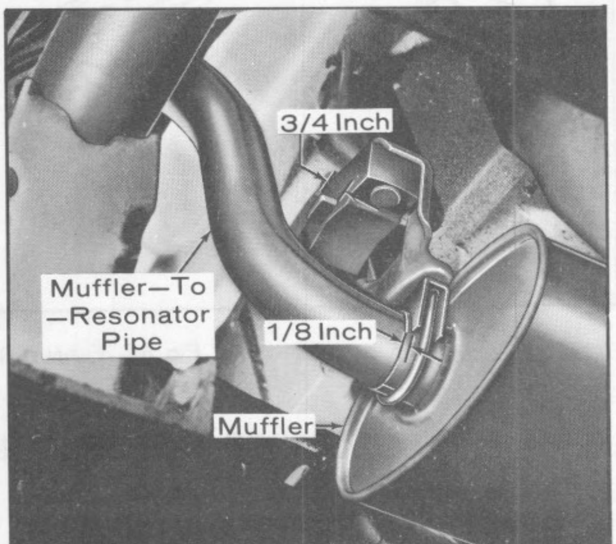


Fig. 8-8 Muffler Outlet Clamp and Hanger

6. Drive muffler off muffler-to-resonator pipe. Use heat as required.

b. Installation

(NOTE: Exhaust pipes and resonator rearward of muffler should be replaced whenever a new muffler is installed.)

1. Position muffler onto muffler-to-resonator pipe so that muffler outlet overlaps pipe approximately 1-1/2 inches.
2. Insert intermediate pipe into muffler inlet approximately 1-1/2 inches.
3. Install muffler-to-resonator pipe hanger. Position hanger with saddle of clamp 1/8 inch in from edge of pipe, Fig. 8-8.
4. Install clamp to front of muffler as shown in Fig. 8-7. Do not tighten clamp.
5. Align exhaust system as described in Note 13.
6. Install resonator hanger to frame and secure with two nuts and bolts.
7. Lower car.

11. Resonator (Except Eldorado)

a. Removal

1. Raise car.

(NOTE: Support muffler to avoid damage to exhaust system.)

2. Remove two nuts securing clamp at rear of muffler and remove clamp.
3. Remove two nuts and bolts securing rear exhaust support to frame at resonator outlet.
4. Separate resonator to muffler pipe from muffler.
5. Remove resonator and pipe by working pipe over rear axle.
6. Remove two nuts, blade, U bolt and remove clamp and support.

b. Installation

1. Install resonator and pipe over rear axle.
2. Install pipe into muffler outlet.
3. Loosely install two nuts and clamp in exhaust hanger at resonator outlet, Fig. 8-9.
4. Install rear exhaust support to frame and secure with two nuts and bolts.
5. Loosely install two nuts and clamp in support at rear of muffler, Fig. 8-8.
6. Align exhaust system as described in Note 13, and tighten clamps.
7. Remove support from muffler, and lower car.

12. Exhaust Deflector (Except Eldorado) (Fig. 8-9)

a. Removal

1. Remove two screws securing deflector to rear frame crossmember and remove deflector.

b. Installation

1. Install deflector to rear frame crossmember and secure with two screws.

13. Exhaust System Alignment (Except Eldorado)

(NOTE: Exhaust system should be properly aligned to avoid contact with frame or floor pan. Blade-type exhaust system hangers are designed to minimize noise transfer through hangers. If system contacts frame or blade is bound up or restricted, vibration and noise can be transmitted into car.)

Position clamps and blades so that hanger blades are horizontal and centered from side to side in the rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone lubricant (not petroleum base lubricant) should be applied in rubber slots of brackets.

If it is necessary to reposition pipes, heat may be used in front of rear axle. Allow pipes to cool before touching them. Do not use acetylene torch behind rear axle.

1. Raise car.
2. Loosen clamps located at front of intermediate pipe, muffler ends, and resonator outlet.
3. Make certain system is horizontal and has adequate clearances.
4. Position intermediate pipe to exhaust pipe so there is approximately 1/8 inch between saddle of clamp and edge of intermediate pipe, Fig. 8-6. Tighten clamp to 50 foot-pounds.
5. Position clamp between intermediate pipe and muffler so there is approximately 1/8 inch between edge of muffler inlet pipe and saddle of clamp, Fig. 8-7. Tighten clamp just enough to prevent separation. Then check alignment of remainder of exhaust system.
6. Position clamp between muffler outlet pipe and muffler-to-resonator pipe so there is approximately 1/8 inch between edge of muffler outlet pipe and saddle of clamp, Fig. 8-8. There should be approximately 1-1/2 inch overlap of outlet pipe with muffler-to-resonator assembly.
7. Align resonator assembly to muffler so there is a minimum of one inch between outlet pipe and rear frame cross member, when measured perpendicular to the angle of pipe at outlet, Fig. 8-9.

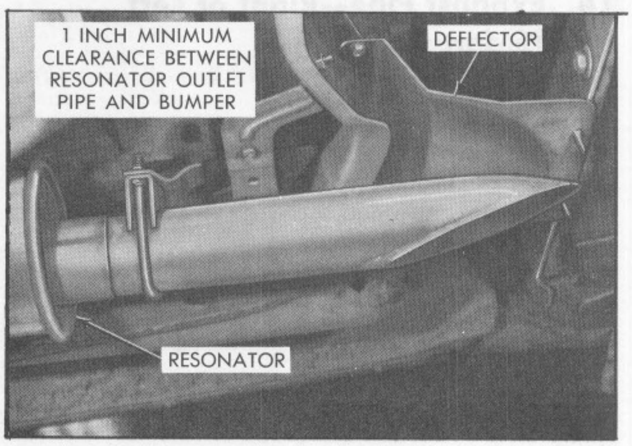


Fig. 8-9 Resonator Outlet Pipe and Hanger

8. Check entire system again to see that there is adequate clearance with frame and body members - at least one inch (except 1/2" at frame rear cross member). Make sure that exhaust system components have at least 3/4 inch clearance from the floor pan to avoid possible overheating of the floor pan and possible damage to the passenger compartment carpets. The weight of the exhaust system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger rubber. If the load is not properly balanced, reposition the pipes at the joints to relieve concentrated loads on any hangers.

9. After adjusting hangers or repositioning pipes, recheck the entire system for adequate clearance to frame members and floor pan and tighten all clamps according to torques specified in the following chart.

10. Lower car.

TORQUE SPECIFICATIONS (EXCEPT ELDORADO)

Material Number	Application	Thread Size	Foot-Pounds
286-M	Exhaust Pipe Brace	5/16-18	35
286-M	Exhaust Pipe to Manifold Nuts	3/8-24	30
300-M	Exhaust Manifold Stud Bolts	3/8-24	35
286-M	Muffler and Resonator Clamp Nuts . . .	3/8-16	35
286-M	Intermediate Pipe to Exhaust Pipe Clamp Nuts	7/16-24	50
6010-M	Resonator Outlet Pipe Hanger Screw . .	20-9	10
300-M	Resonator Clamp Nuts	5/16-18	35
280-M	Deflector	1/4-20	5

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)

GENERAL DESCRIPTION—ELDORADO EXHAUST SYSTEM

(NOTE: The following information pertains only to those features that are exclusive to the Eldorado exhaust system.)

The exhaust system on the 6L body style, Fig. 8-8, consists of two exhaust pipes, an exhaust "Y" pipe, a muffler, and a resonator assembly. The system is supported to the frame by blade-type hangers, one at the muffler outlet and one on the resonator outlet. The forward portion of the system is supported by its connection to the exhaust manifolds.

SERVICE INFORMATION—ELDORADO EXHAUST SYSTEM

14. Exhaust Pipe—Right or Left (Eldorado Only)

a. Removal

1. Raise car.
2. Remove clamp securing exhaust pipe to "Y" pipe at side to be removed, Fig. 8-11.
3. Remove two nuts securing exhaust pipe to manifold and disengage pipe from manifold.
4. Cut exhaust pipe at "Y" pipe and remove pipe.

(NOTE: Left hand pipe is removed up through top. Right hand pipe is removed down through bottom.)

5. Remove remaining section of exhaust pipe from "Y" pipe.

b. Installation

1. Insert rear portion of exhaust pipe into forward portion of "Y" pipe.
2. Position exhaust pipe to exhaust manifold and loosely install two nuts to manifold studs.
3. Reposition rear of exhaust pipe so that pipes overlap about 1-1/2 inches. Loosely install clamp with saddle of clamp outboard of system and with 1/8 inch between saddle of clamp and edge of pipe, Fig. 8-11.
4. Align exhaust system as described in Note 19, and tighten manifold nuts to 30 foot-pounds.
5. Lower car.

15. Exhaust "Y" Pipe (Eldorado Only)

a. Removal

1. Raise car.
2. Remove one exhaust pipe from one side as described in Note 14a.

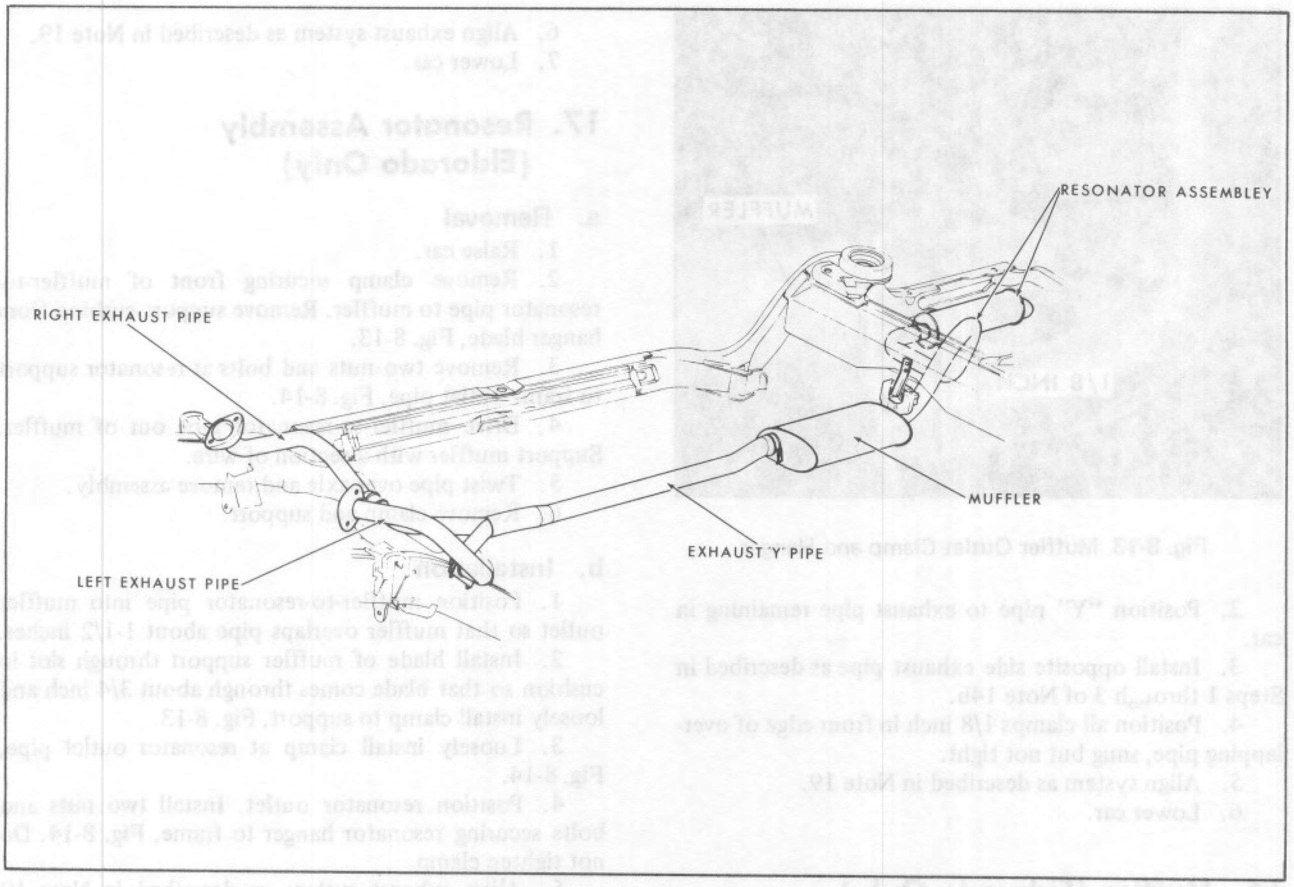


Fig. 8-10 Eldorado Exhaust System

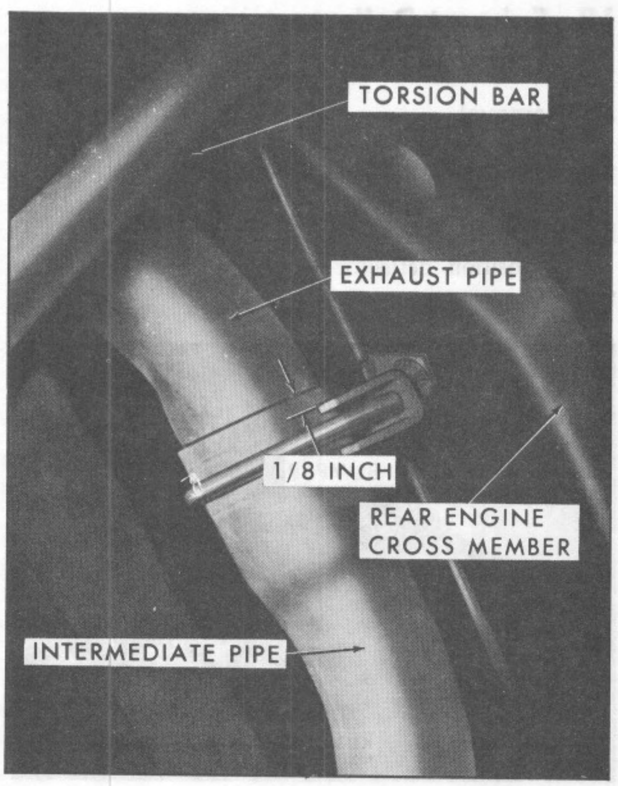


Fig. 8-11 Exhaust Pipe at "Y" Pipe

3. Remove clamp securing "Y" pipe to exhaust pipe at opposite side.

4. Remove clamp securing "Y" pipe to muffler inlet and drive muffler off of "Y" pipe, Fig. 8-12. Use heat as required.

5. Remove "Y" pipe from exhaust pipe by twisting and rocking motions.

b. Installation

1. Slide "Y" pipe into muffler about 1-1/2 inches, Fig. 8-12.

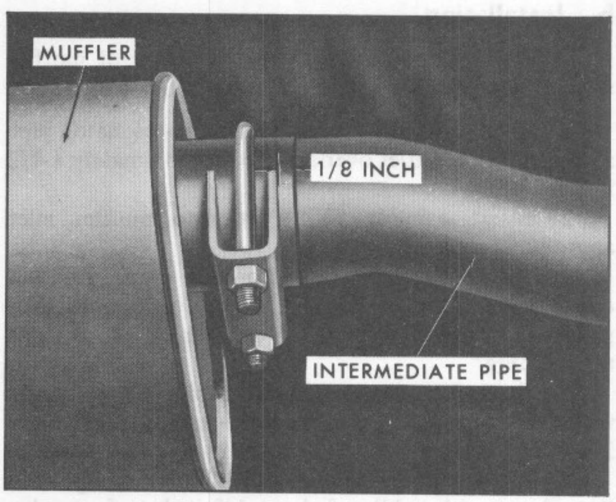


Fig. 8-12 Intermediate Pipe at Muffler

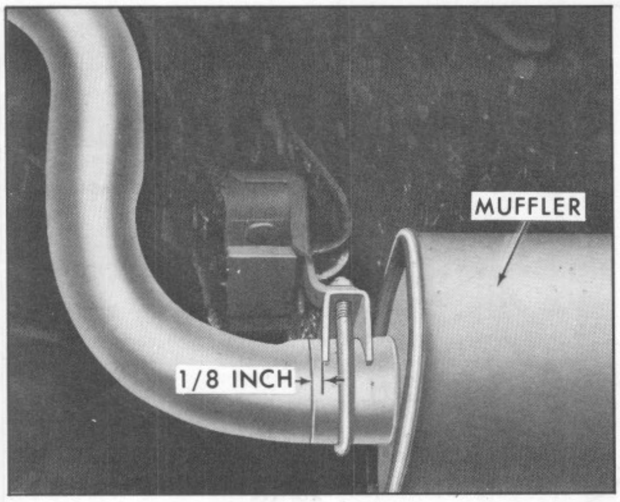


Fig. 8-13 Muffler Outlet Clamp and Hanger

2. Position "Y" pipe to exhaust pipe remaining in car.
3. Install opposite side exhaust pipe as described in Steps 1 through 3 of Note 14b.
4. Position all clamps 1/8 inch in from edge of overlapping pipe, snug but not tight.
5. Align system as described in Note 19.
6. Lower car.

16. Muffler (Eldorado Only)

a. Removal

1. Raise car.
2. Remove two nuts securing clamp at front of muffler to exhaust "Y" pipe and remove clamp, Fig. 8-12.
3. Remove two nuts from clamp at rear of muffler and remove clamp. Disengage hanger, Fig. 8-13.
4. Drive muffler off of exhaust "Y" pipe. Use heat as required.
5. Drive muffler off muffler-to-resonator pipe. Use heat as required.

b. Installation

(NOTE: Resonator and pipes rearward of muffler should be replaced whenever a new muffler is installed.)

1. Position muffler onto muffler-to-resonator pipe so that muffler outlet overlaps pipe approximately 1-1/2 inches.
2. Insert exhaust "Y" pipe into muffler inlet approximately 1-1/2 inches.
3. Install muffler-to-resonator pipe clamp. Position clamp with saddle of clamp 1/2 inch in from edge of pipe and toward left side of car, Fig. 8-13. Do not tighten nuts.
4. Engage muffler-to-resonator pipe hanger blade with slot in hanger so that blade sticks out from hanger 3/4 inch, Fig. 8-13.
5. Install muffler to exhaust "Y" pipe clamp. Position clamp with saddle of clamp 1/8 inch in from edge of pipe and toward left side of car, Fig. 8-12.
6. Align exhaust system as described in Note 19.
7. Lower car.

17. Resonator Assembly (Eldorado Only)

a. Removal

1. Raise car.
2. Remove clamp securing front of muffler-to-resonator pipe to muffler. Remove support cushion from hanger blade, Fig. 8-13.
3. Remove two nuts and bolts at resonator support to frame outlet pipe, Fig. 8-14.
4. Drive muffler-to-resonator pipe out of muffler. Support muffler with a section of wire.
5. Twist pipe over axle and remove assembly.
6. Remove clamp and support.

b. Installation

1. Position muffler-to-resonator pipe into muffler outlet so that muffler overlaps pipe about 1-1/2 inches.
2. Install blade of muffler support through slot in cushion so that blade comes through about 3/4 inch and loosely install clamp to support, Fig. 8-13.
3. Loosely install clamp at resonator outlet pipe, Fig. 8-14.
4. Position resonator outlet. Install two nuts and bolts securing resonator hanger to frame, Fig. 8-14. Do not tighten clamp.
5. Align exhaust system as described in Note 19 and tighten clamps.
6. Lower car.

18. Exhaust Deflector (Eldorado Only) (Fig. 8-14)

a. Removal

1. Remove two screws securing deflector to rear bumper and remove deflector.

b. Installation

1. Position deflector to rear bumper and secure with two screws.

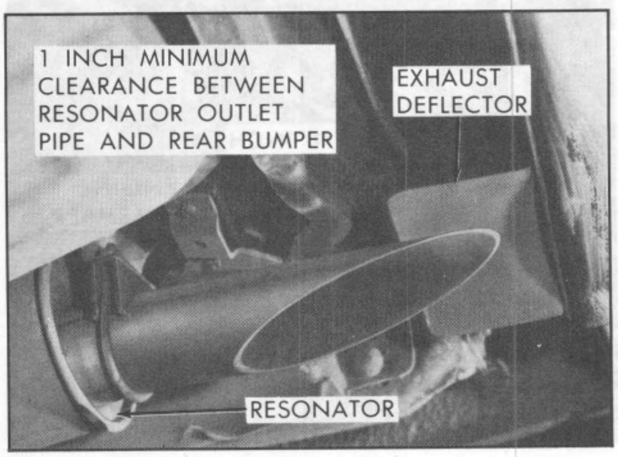


Fig. 8-14 Resonator Outlet Pipe and Hanger

19. Alignment—Eldorado Only

Position clamps and blades so that hanger blades are horizontal and centered from side to side in rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone (not petroleum base lubricant) should be applied in rubber slots of brackets. The hangers must not bind when exhaust system expands.

1. Raise car.
2. Loosen clamps located at muffler outlet and resonator outlet.
3. Check hangers. Ends of hangers should stick out 3/4 inch from brackets. The muffler should overlap all pipes approximately 1-1/2 inch. The clamps should be positioned with 1/8 inch between the saddle of clamps and muffler pipes.
4. Make certain that resonator is horizontal and that it has a minimum of 3/4 inch clearance from fuel tank.
5. The entire system should be checked to see that there is adequate clearance to frame, suspension, drive line, and body members, at least 13/16 inch. Make sure that exhaust system components have at least 3/4 inch clearance from the floor pan to avoid possible overheating of the floor pan and possible damage to the passenger compartment carpets. The weight of the system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger. If load is not properly balanced, reposition the pipes at the joints to relieve any concentrated loads.
6. After adjusting hangers or repositioning pipes, recheck entire system for adequate clearance and tighten all clamps according to torques specified in the following chart.
7. Lower car.

TORQUE SPECIFICATIONS (ELDORADO ONLY)

Material Number	Application	Thread Size	Foot-Pounds
Special	Exhaust Pipe to Manifold Nuts	3/8-24	30
286-M	Exhaust Pipe to Y-Pipe Clamp Nuts	3/8-16	30
286-M	Muffler Clamp Nuts	3/8-16	35
280-M	Deflector	1/4-20	5
6010-M	Resonator Outlet Pipe Screw	20-9	10
300-M	Resonator Clamp Nuts	5/16-18	35

GENERAL DESCRIPTION

Service information pertaining only to those features that are exclusive to the Eldorado steering is included at the end of this section, beginning on page 9-64.

A constant ratio steering gear (17.5.1) is used on Fleetwood Seventy-Fives and commercial vehicles. Variable ratio power steering is utilized on all other Cadillacs (16.0:1 on center, 13.0:1 at full turn).

Variable ratio steering is accomplished by a pitman shaft sector incorporating a short tooth on either side of a long center tooth, rather than a sector with three teeth of equal length as in constant ratio steering.

The steering gear is mounted on the left frame side rail and is secured by three mounting screws. The gear is joined to the steering shaft by a flexible coupling that helps reduce the transmission of noises and road shock to the car interior.

A constant displacement vane type pump provides hydraulic pressure for the steering system. The pump is located on the left front corner of the engine, Fig. 9-1, and is belt driven by the engine crankshaft pulley.

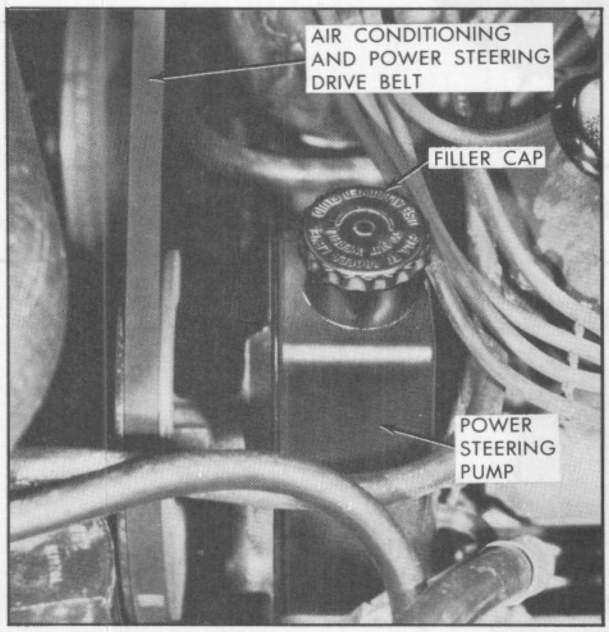


Fig. 9-1 Steering Pump Location

Steering Linkage—Except Eldorado

The steering linkage, Fig. 9-2 consists of a pitman arm, idler arm and bracket, two pivot assemblies, and a one-piece forged steel drag link. The pitman arm connects the left side of the drag link to the steering gear and the idler arm and bracket assembly connect the right side of the drag link to the frame. The tie rods serve as connecting links between the drag link and steering arms.

All cars are fitted with serviceable pivots. They should be inspected at each engine oil change for damage or lack of enough lubricant. Enough lubricant is in the pivot if grease is expelled from the lip of the pivot seal when the seal is carefully squeezed by hand.

Damaged seal replacement and steering linkage joint lubricant are covered under notes 25 and 26.

Steering Gear (Fig. 9-3)

The major internal components of the variable ratio steering gear are the rotary valve assembly steering worm, rack-piston assembly, and the pitman shaft. The movement of these parts, while turning or parking, is aided by hydraulic pressure supplied by the pump. Manual steering is always available at times when the engine is not running, or in the event of pump or belt failure. Steering effort is increased under such conditions.

The steering stub shaft, rotary valve, worm shaft, and rack-piston assembly are all "in line". The rack-piston in the variable ratio steering gear is modified to accommodate the larger center tooth on the pitman shaft gear. All oil passages are internal within the gear housing, except for the pressure and return hoses between the gear and the pump.

The hydraulic rotary valve is concentric with the input shaft and is contained in the upper section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar allows the spool

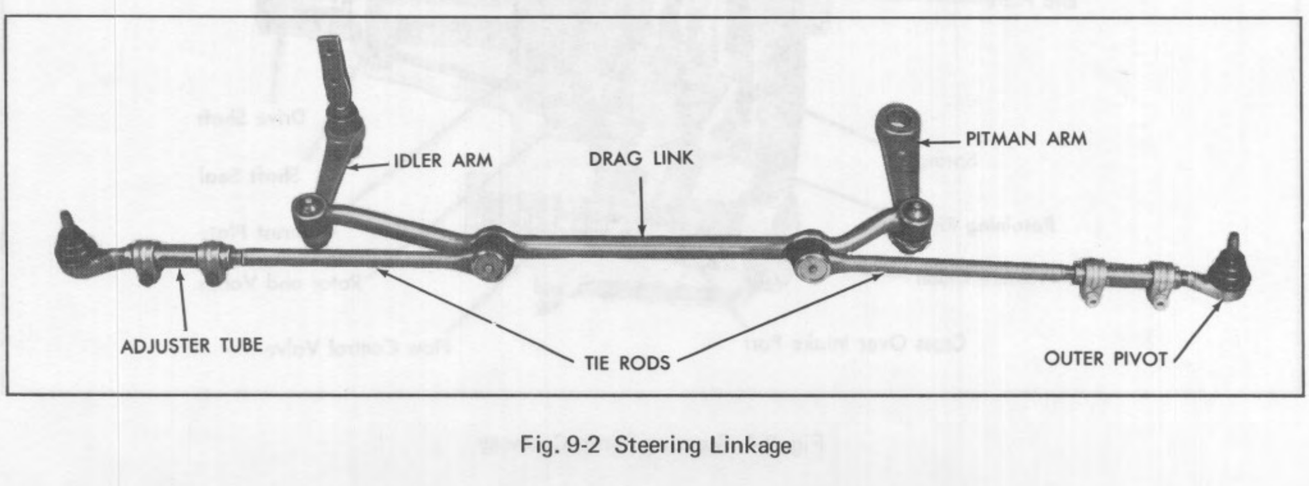


Fig. 9-2 Steering Linkage

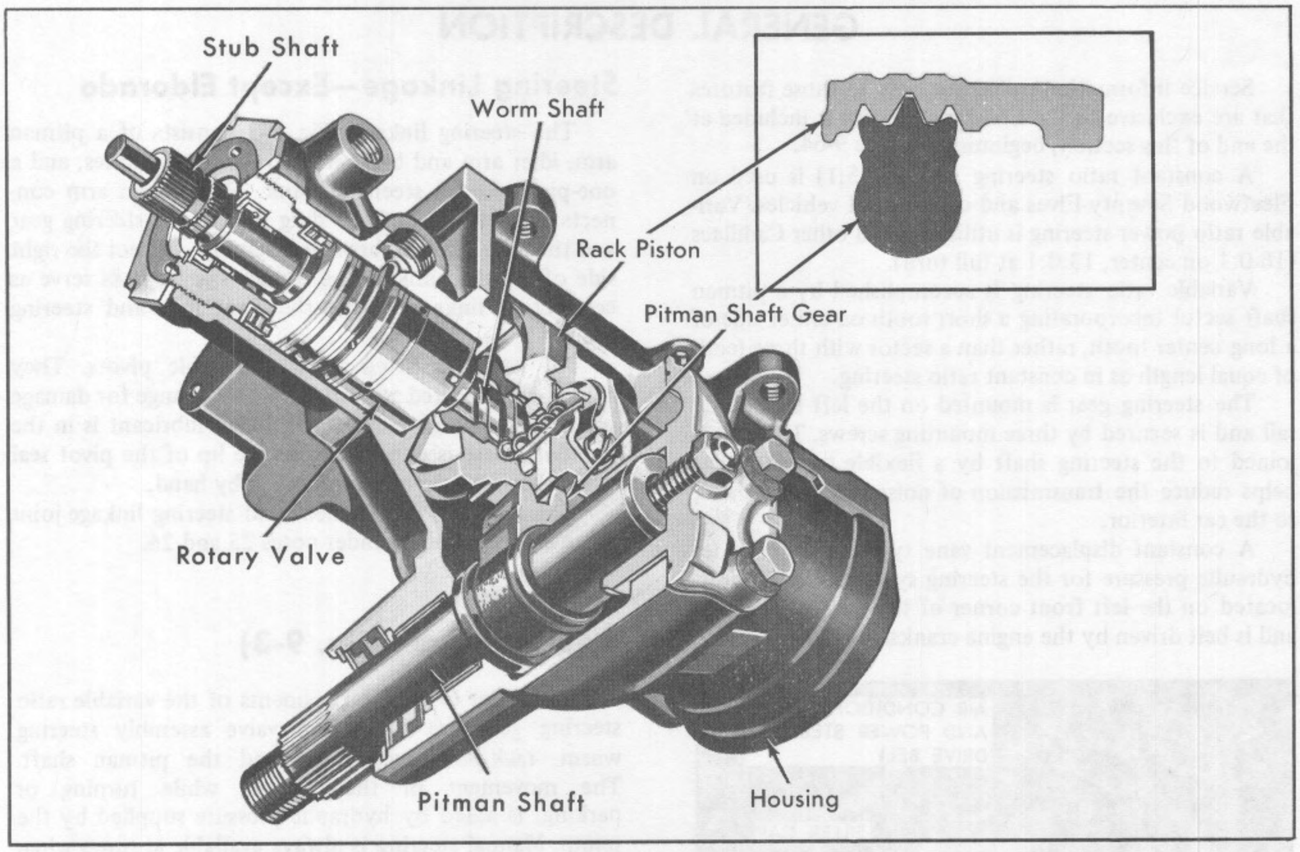


Fig. 9-3 Steering Gear Cutaway

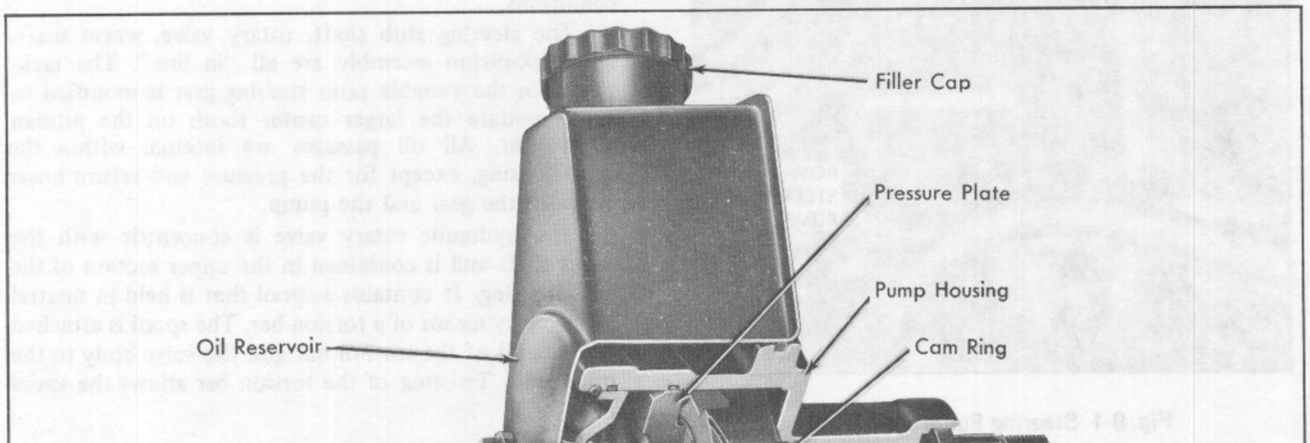


Fig. 9-4 Steering Pump Cutaway

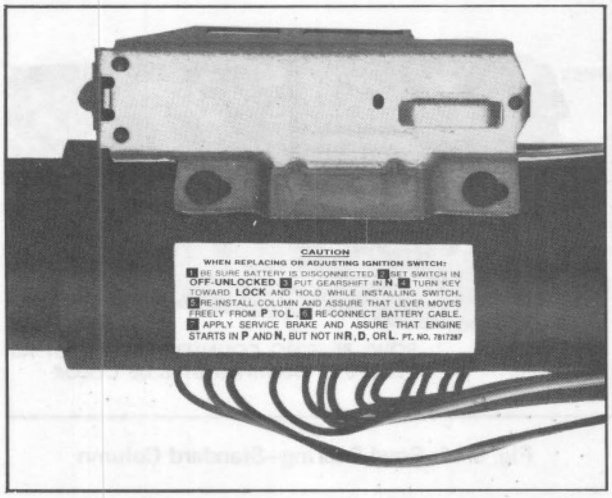


Fig. 9-5 Instruction Label

to rotate in relation to the valve body, thereby operating the valve.

Under normal driving conditions the steering wheel effort will range from 1 to 1-1/2 pounds, and parking effort will range from 2 to 2-1/2 pounds.

Steering Pump

The major components of the power steering pump are the oil reservoir, drive shaft, pump housing, cam ring, pressure plate, thrust plate, flow control valve, and rotor and vane assembly. The pump housing and component parts are encased in the oil reservoir. The reservoir filler cap has a dipstick attached to show the oil level in the reservoir.

There are two bore openings at the rear of the pump housing. The larger of these openings contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve, and spring. The flow control orifice is part of the pressure line union. A pressure relief valve inside the flow control valve limits pump pressure to 1425-1475 psi.

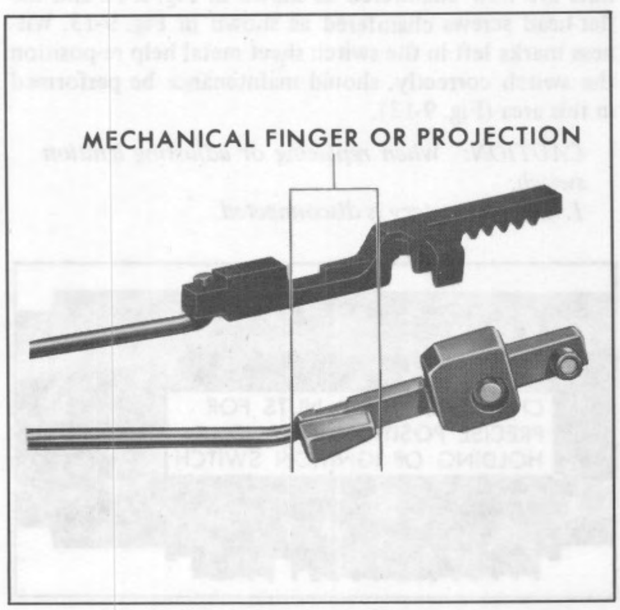


Fig. 9-6 Actuator Rack

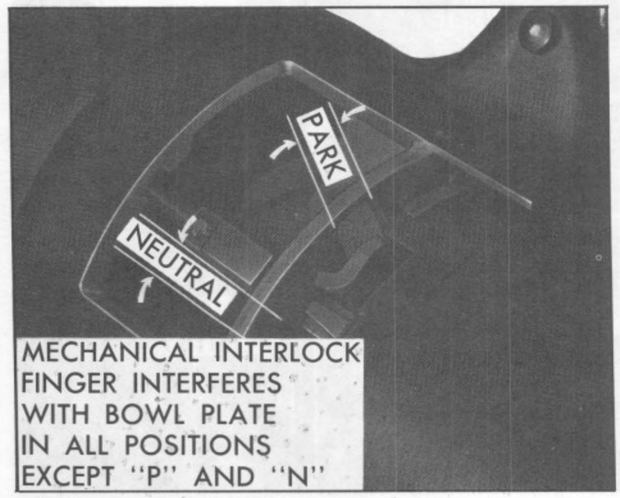


Fig. 9-7 Bowl Plate

Mechanical Neutral Start System

Cadillac steering columns contain a mechanical neutral start system. It can be identified by the yellow and black instruction label attached to the jacket adjacent to the ignition switch (Fig. 9-5). This system relies on a mechanical block, rather than the neutral switch to prevent starting the engine in other than "P" (Park) or "N" (Neutral).

The mechanical block is achieved by a cast in finger added to the switch actuator rack (Fig. 9-6) which interferes with the bowl plate (Fig. 9-7) in all shift positions except "N" (Neutral) or "P" (Park). This interference

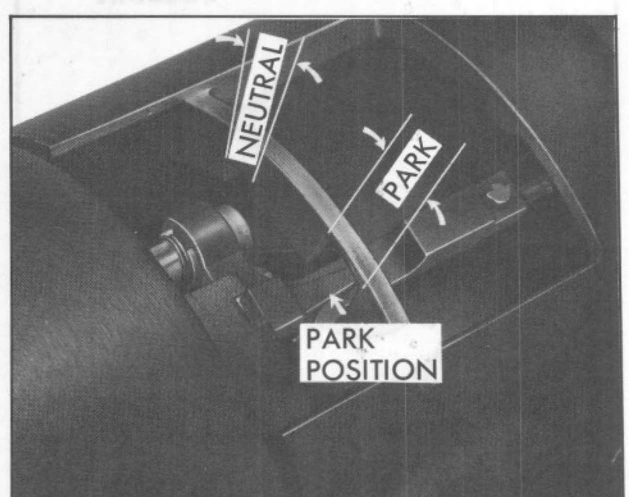


Fig. 9-8 Bowl Plate—Park Slot

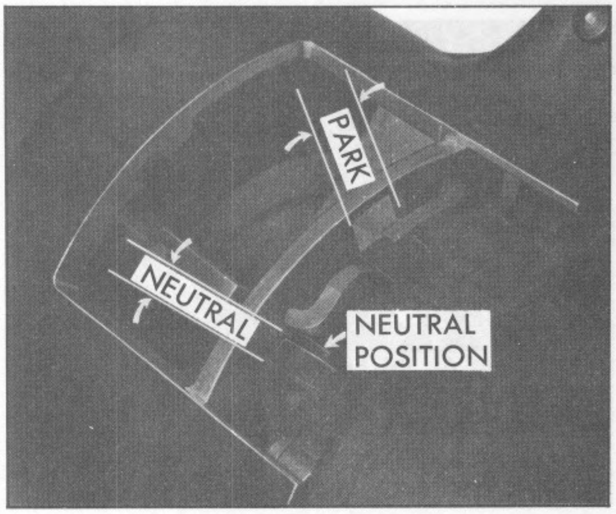


Fig. 9-9 Bowl Plate—Neutral Slot

prevents rotation of the lock cylinder into the "START" position.

In either "P" or "N", this finger passes through the bowl plate (Figs. 9-8 and 9-9) slots, allowing the lock cylinder full rotational travel into the "Start" position.

Servicing procedures remain the same as does

Fig. 9-10 Shift Bowl

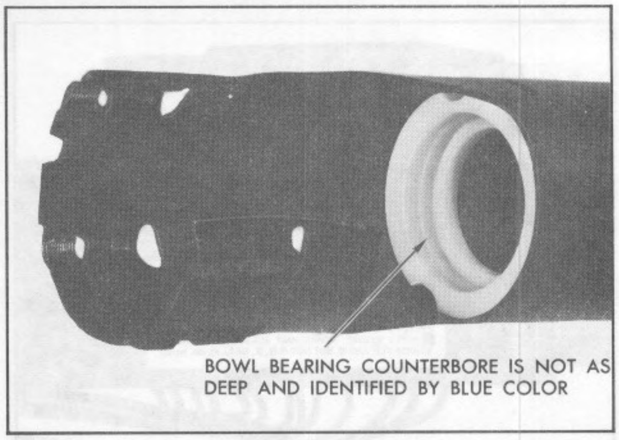


Fig. 9-11 Bowl Bearing—Standard Column

assembly and disassembly. Some parts have been changed dimensionally and are identified as follows:

1. Mechanical neutral start system column is identified by yellow instruction tag adjacent to the ignition switch (Fig. 9-5).
2. The switch actuator rack has the projection or cast in finger and is dyed black on the standard column. The T & T column has a small strip of blue paint (Fig. 9-6).
3. The shift bowl park and neutral slots are more precise in size and location. On the standard column it is marked with yellow paint adjacent to the "Park" slot. The tilt and telescope is different in design. (Fig. 9-10)
4. The counterbore in the standard column lower bowl bearing is not as deep. This bearing is blue (Fig. 9-11).

CAUTION: Do not substitute "old" style parts in service as this could defeat the mechanical neutral start system.

The fastening of the ignition switch has also been changed to improve holding and positioning. The weld nuts are now chamfered as shown in Fig. 9-12 and the flat-head screws chamfered as shown in Fig. 9-13. Witness marks left in the switch sheet metal help re-position the switch correctly, should maintenance be performed in this area (Fig. 9-13).

CAUTION: When replacing or adjusting ignition switch:
1. Be sure battery is disconnected.

Fig. 9-12 Chamfered Nuts

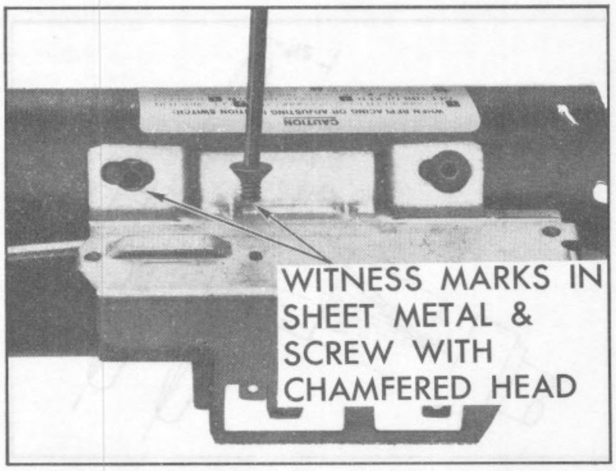


Fig. 9-13 Witness Marks

2. *Set switch in OFF-UNLOCKED.*
3. *Put gearshift in "N".*
4. *Turn key toward LOCK and hold while installing switch.*
5. *Re-install column and assure that lever moves freely from "P" to "L".*
6. *Re-connect battery cable.*
7. *Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".*

If either the ignition switch or column jacket is replaced, any "witness" marks (Fig. 9-13) on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

Energy Absorbing Steering Column (Fig. 9-14)

The steering columns used on Cadillac automobiles are of the energy absorbing type. The outer jacket consists of two tubes of different diameters joined together by four rows of ball bearings (36 balls total) that are pressed into position. During impact, the ball bearings roll along the jacket wall allowing the smaller, lower end of the jacket to collapse within the larger upper end. The steering shaft is constructed in two parts fitting together so that they can telescope. The shift tube is constructed in two telescoping parts. An injected plastic joint holds the telescoping parts of both the steering shaft and the shift tube so that they remain in the proper relationship under normal operation.

The column is supported in the car at the upper mounting position by a bracket containing two release capsules. If an excessive impact load acts on the upper end of the column, the upper mount release capsules will shear and allow the column to collapse downward.

CAUTION: Do not use bolts longer than specified at the upper mounting capsule bracket to jacket attachment as it may adversely effect the column collapse.

Equally important is the correct torquing of all nuts and bolts. Follow exactly the torque recommendations

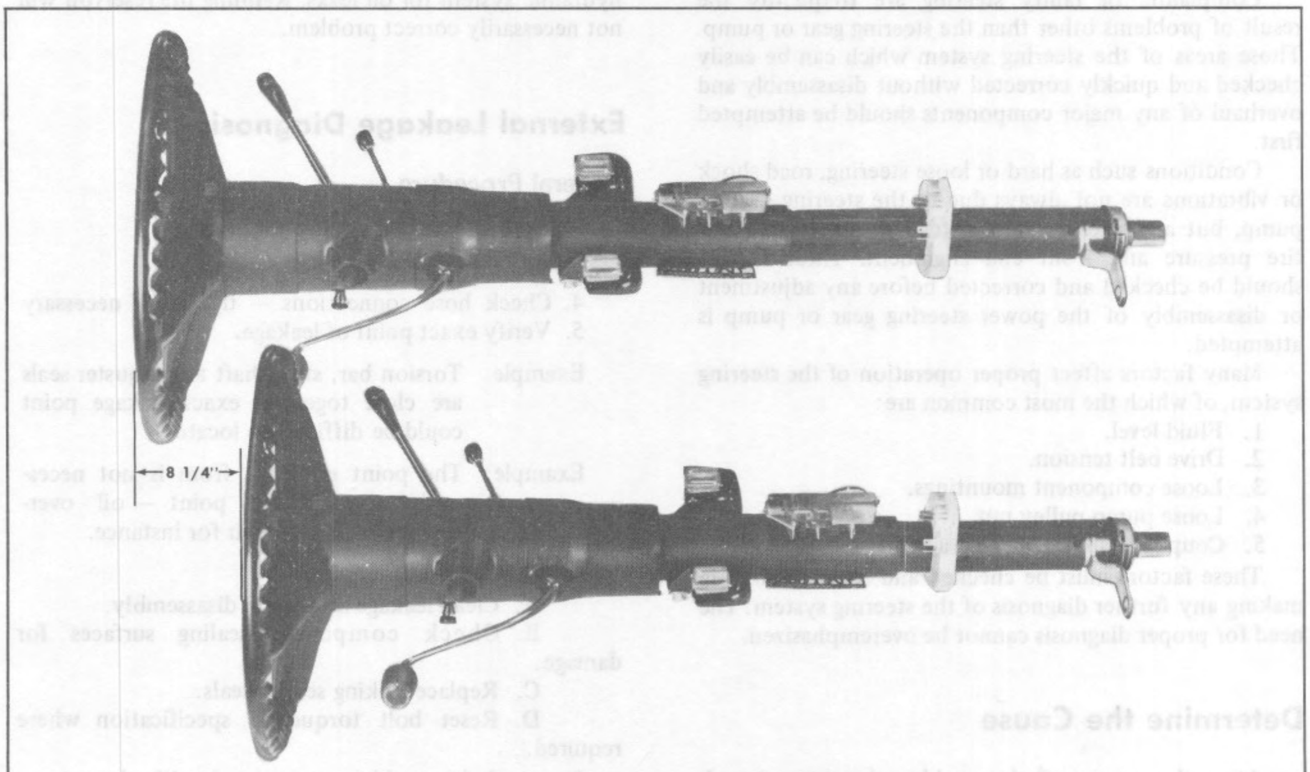


Fig. 9-14 Energy Absorbing Steering Column

given in every step. The column must be handled and serviced with extreme care. Use only the specified screws, bolts and nuts during assembly.

At no time should the column, shift tube, or steering shaft be struck from either end with a hammer, or pulled excessively. Care must also be taken never to let the column drop when removing or installing to prevent accidental collapse of either the steering shaft or the outer jacket.

Tilt and Telescope Steering Column (Figs. 9-15 and 9-86)

The Tilt and Telescope steering column consists of a steering shaft with a spherical joint, adjusting and locking mechanism for tilt adjustment; a telescoping upper shaft and yoke assembly, and locking mechanism for telescopic adjustment. These adjustments are made independently of each other.

The up and down tilt action is achieved by pulling upward on a small lever located on the left side of the steering column just below the directional signal lever, which allows the steering wheel to be positioned at any one of six possible angles. Releasing the lever will lock the wheel in position.

A knob located at the top of the steering column, where it meets the steering wheel, releases the steering column telescoping mechanism for adjustment. To lengthen or shorten the steering column within its range, move the telescope lock-unlock knob fully left, push or pull the steering wheel to the desired position, and move the lock-unlock knob fully right.

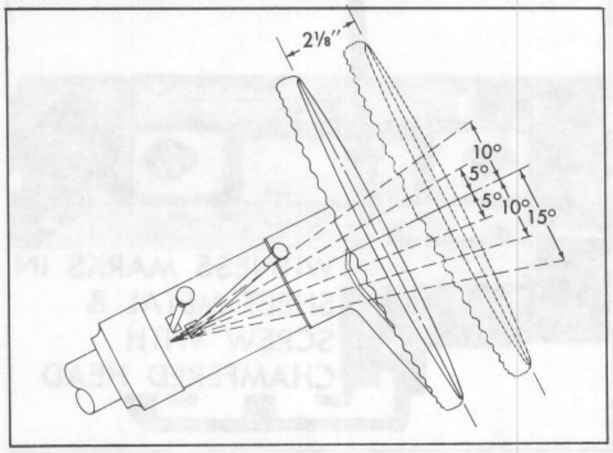


Fig. 9-15 Tilt and Telescope Steering Wheel

Service operations on the steering gear, power steering pump, and steering linkage are exactly the same on cars equipped with a Tilt and Telescope wheel as on cars with the standard wheel. Steering gear adjustments are performed in the same manner and to the same specifications. Steering column to gear alignment and steering wheel alignment also are the same.

STEERING SYSTEM DIAGNOSIS

Complaints of faulty steering are frequently the result of problems other than the steering gear or pump. Those areas of the steering system which can be easily checked and quickly corrected without disassembly and overhaul of any major components should be attempted first.

Conditions such as hard or loose steering, road shock or vibrations are not always due to the steering gear or pump, but are often related instead to such factors as tire pressure and front end alignment. These factors should be checked and corrected before any adjustment or disassembly of the power steering gear or pump is attempted.

Many factors affect proper operation of the steering system, of which the most common are:

1. Fluid level.
2. Drive belt tension.
3. Loose component mountings.
4. Loose pump pulley nut.
5. Coupling rubbing on gear adjuster.

These factors must be checked and corrected before making any further diagnosis of the steering system. The need for proper diagnosis cannot be overemphasized.

Determine the Cause

After the source of the problem has been found, determine the cause. For example, if the oil level in the reservoir is found to be low, refill and check the entire hydraulic system for oil leaks. Refilling the reservoir will not necessarily correct problem.

External Leakage Diagnosis

General Procedure

1. Wipe suspected area dry.
2. Check for overfilled reservoir.
3. Check for oil aeration and overflow.
4. Check hose connections – tighten if necessary
5. Verify exact point of leakage.

Example: Torsion bar, stub shaft and adjuster seals are close together; exact leakage point could be difficult to locate.

Example: The point oil drips from is not necessarily the leakage point – oil overflowing from reservoir for instance.

6. When service is required:

A. Clean leakage area upon disassembly.

B. Check component sealing surfaces for damage.

C. Replace leaking seal or seals.

D. Reset bolt torque to specification where required.

Some of the problems associated with the power steering systems may be described as:

1. Oil leakage on garage floor.

2. Oil leaks visible on steering gear, pump, or anywhere else on the left side of engine compartment.

3. Growling noise especially when parking or when engine is cold.

4. Loss of power when parking.

5. Heavy steering effort.

For the purpose of trouble shooting problems of this nature, assume that there is an external leak in the power steering system, and follow the steps given in this procedure.

This procedure is a guide, which will enable you to locate, identify, and repair leaks in the power steering system. It contains:

A. Diagram of the complete power steering system with the areas of potential leakage identified.

B. Recommended procedure for locating external leakage in the vehicle.

C. Areas of leakage to be checked, which can be serviced at once.

D. Part replacement recommendations.

E. Diagram of the actual areas where leakage will be observed and the action recommended to repair this leakage.

External Leakage Check

The purpose of the diagnostic procedure is to pinpoint the location of the leak. The method outlined in this procedure can be followed to locate the leak and repair it.

In some cases you will be able to locate the leak easily. However, seepage type leaks may be more difficult to isolate. For seepage leaks, the following method is recommended.

A. With the vehicle's engine off, wipe the complete power steering system dry (gear, pump, hoses, and connections).

B. Check oil level in pump's reservoir and bring to proper level.

C. Start engine and turn steering wheel from stop to stop several times. Do not hold for any length of time as this can damage the power steering pump. It is easier if someone else operates the steering wheel while you check for seepage.

D. Find the exact area of leakage.

E. Refer to the diagnostic chart to find the recommended method of repair.

Quick Fixes

The purpose of this section is to acquaint you with the types of leakage which can be repaired very easily. It contains information on reservoir oil level, the hoses and the hose connections.

An overfilled pump reservoir can be a cause for leakage complaint. The oil in the steering system expands as heated during normal usage. If overfilled the excess is forced through the breather cap vent and may be sprayed over the engine by air blast. Operate the engine and steering system until normal operating temperature is obtained. Remove the reservoir cap and check the graduated level on the dipstick. Add or remove fluid to bring oil to proper level. (See Note 1)

Seepage at the hose connections can be a cause for leakage complaint and can be due to loose hose connections. If leakage is observed at the hose connections, and the fitting is not cross threaded, tighten the fitting at the gear to 35 foot-pounds maximum.

The fitting at the power steering pump should be tightened to 45 foot-pounds maximum. If tightening to this torque does not stop the leak, refer to the diagnostic chart.

If either the return hose or the pressure hose leaks, replace the hose.

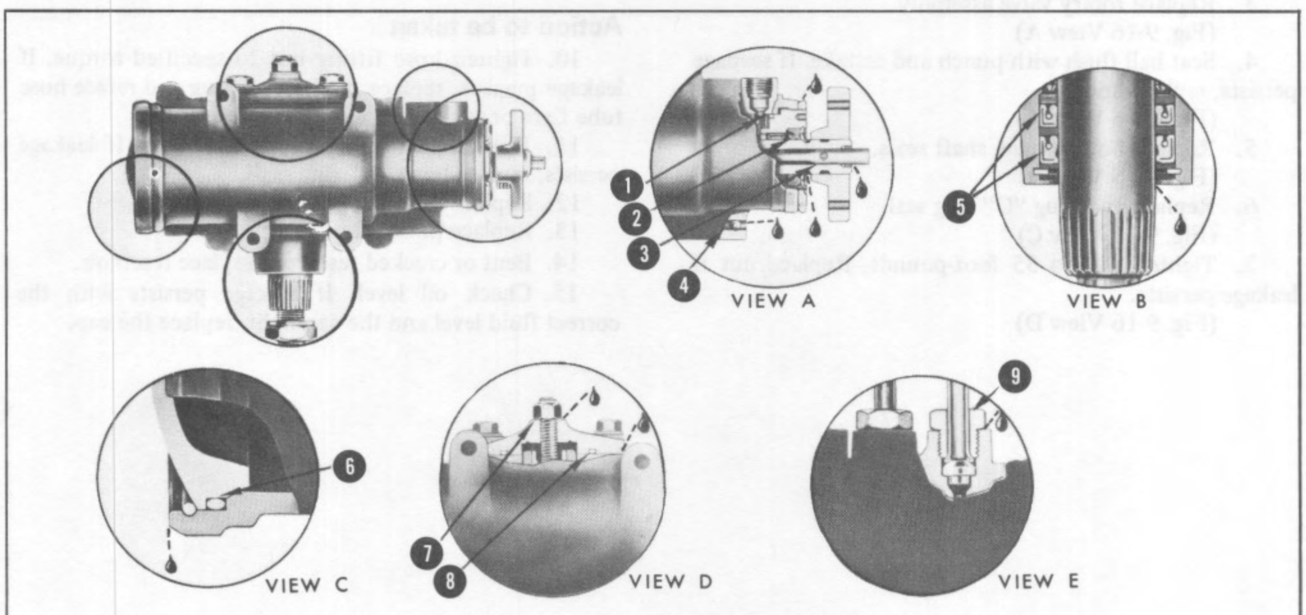


Fig. 9-16 Steering Gear Leakage Areas

Component Replacement Recommendations

Lip seals, which seal rotating shafts, require special treatment. This type of seal is used on the steering gear at the pitman shaft, at the stub shaft, and on the drive shaft of the pump. When leakage occurs in one of these areas, always replace the seal or seals, after inspecting and thoroughly cleaning the sealing surfaces. Replace the shaft only if very severe pitting is found. If the corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the shaft only if the leakage cannot be stopped by smoothing with crocus cloth first.

Housing or Cover Seepage – Both the power steering gear and pump assemblies are leakage checked before shipment. However, occasionally oil seepage may occur from the gear or pump other than from the seal areas. If this type of leakage is found, replace the leaking part.

Individual Leakage Breakdown

The following diagrams have been prepared to show the potential areas of leakage. If leakage occurs in the areas shown, replace the part listed.

Gear

Pay particular attention to the exact source of leakage in this area. Due to the closeness of the various seals, the wrong diagnosis will result in an ineffective repair.

Action to be taken

1. Replace adjuster plug "O" ring seal.
   (Fig. 9-16 View A)
2. Replace dust and stub shaft seals.
   (Fig. 9-16 View A)
3. Replace rotary valve assembly.
   (Fig. 9-16 View A)
4. Seat ball flush with punch and restake. If seepage persists, replace housing.
   (Fig. 9-16 View A)
5. Replace both pitman shaft seals.
   (Fig. 9-16 View B)
6. Replace end plug "O" ring seal.
   (Fig. 9-16 View C)
7. Tighten nut to 35 foot-pounds. Replace nut if leakage persists.
   (Fig. 9-16 View D)

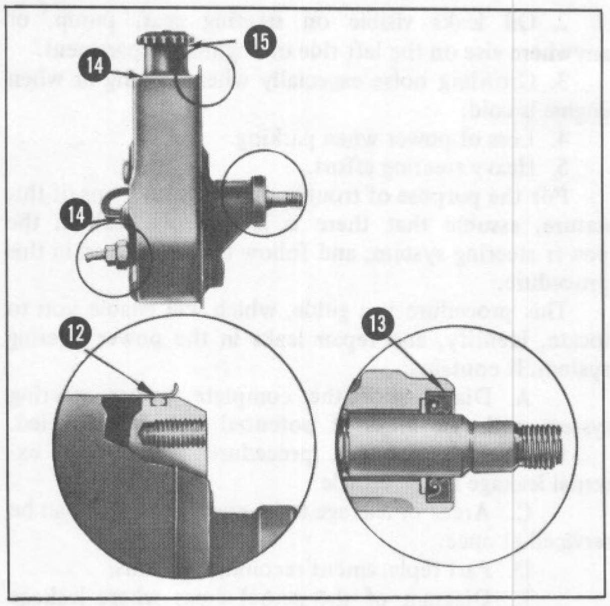


Fig. 9-17 Steering Pump Leakage Areas

8. Tighten side cover screws to 35 foot-pounds. Replace side cover seal if leakage persists.
   (Fig. 9-16 View D)
9. If leakage persists upon tightening the fitting nut to specified torque replace brass connector and reface hose tube flare. If leakage is due to damaged threads (cross threaded), replace brass connector. Repair fitting nut or replace hose as required. If housing threads are badly stripped, replace housing.
   (Fig. 9-16 View E)

Pump (Fig. 9-17)

Action to be taken

10. Tighten hose fitting nut to specified torque. If leakage persists, replace discharge fitting and reface hose tube flare or replace hose as required.
11. Tighten fitting to specified torque. If leakage persists, replace both "O" ring seals.
12. Replace reservoir "O" ring.
13. Replace pump shaft seal.
14. Bent or cracked reservoir, replace reservoir.
15. Check oil level. If leakage persists with the correct fluid level and the cap tight, replace the cap.

STEERING GEAR AND PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Hissing noise in steering gear.	There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Slight "hiss" is normal and in no way affects steering. Do not replace valve unless "hiss" is extremely objectionable. A replacement valve will also exhibit slight noise and is not always a cure for the objection. Investigate clearance around flexible coupling rivets. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal-to-metal contacts through flexible coupling will transmit valve "hiss" into passenger compartment through the steering column.
Rattle or chuckle noise in steering gear.	Gear loose on frame.	Check gear-to-frame mounting screws. Tighten screws to specified torque.
	Steering linkage looseness.	Check linkage pivot points for wear. Replace if necessary.
	Loose pitman shaft over center adjustment.	Adjust to specifications.
	Pressure hose touching other parts of car.	Adjust hose position.
	(NOTE: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.)	
	Loose pitman arm.	Tighten pitman arm to specifications.
Squawk noise in steering gear when turning or recovering from a turn.	Dampener "O" ring on gear valve spool cut spool cut or hardened.	Replace dampener "O" ring.
Chirp noise in steering pump.	Loose belt.	Adjust belt tension to specification.
Belt squeal (Particularly noticeable at full wheel travel and stand still parking).	Loose belt.	Adjust belt tension to specification.
Growl noise in steering pump.	Excessive back pressure in hoses or steering gear caused by restriction.	Locate restriction and correct. Replace part if necessary.
Growl noise in steering pump (Particularly noticeable at standstill parking).	Scored pressure plates, thrust plate or rotor.	Replace parts, disassemble gear and clean. Flush hoses.
	Extreme wear of cam ring.	Replace parts, disassemble gear and clean. Flush Hoses.
Groan noise in steering pump.	Low fluid level.	Fill reservoir to proper level.
	Air in the fluid. Poor pressure hose connection.	Tighten connector to specified torque. Bleed system by operating steering from right to left -- full turn.
Rattle or Knock noise in steering pump.	Loose pump pulley nut.	Tighten nut to specified torque.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Rattle noise in steering pump.	Vanes not installed properly.	Install properly.
	Vanes sticking in rotor slots.	Free up by removing burrs, varnish or dirt.
Swish noise in steering pump.	Defective flow control valve.	Replace part.
Whine noise in steering pump.	Pump shaft bearing scored.	Replace housing and shaft. Disassemble gear and clean. Flush hoses.
Poor return of steering wheel to center.	Lack of lubrication in linkage and spherical joints.	Lube linkage and spherical joints. Check seals for damage and replace if necessary.
	Lower coupling flange rubbing against steering gear adjuster plug.	Loosen pinch bolt and assemble properly.
	Steering gear to column misalignment.	Align steering column.
	Tires not properly inflated.	Inflate to specified pressure.
	Improper front wheel alignment.	Check and adjust as necessary.
		With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or spherical joints are binding.
	Steering linkage binding.	Replace pivots.
	Spherical joints binding.	Replace spherical joints.
	(Turn steering wheel and listen for internal rubbing in column - check causes listed and correct as directed.)	
	Steering wheel rubbing against directional signal housing.	Adjust steering jacket.
	Tight or frozen steering shaft bearings.	Replace bearings.
	Rubber spacer binding in shift tube.	Make certain spacer is properly seated. Lubricate inside diameter with silicone.
	Sticky or plugged valve spool.	Remove and clean or replace valve.
	Steering gear adjustments over specifications.	Check adjustment with gear out of vehicle. Adjust as required.
	Tight or frozen U-joint in steering shaft – Eldorado only.	Replace U-joint.
(Keep in mind road condition and wind. Test car on flat road going in both directions)	Front end misaligned.	Adjust to specifications. (Usually excess cross-caster)
	Radial tire lateral force (conicity)	Rotate tires to equalize conicity force (REA section 10).
	Unbalanced steering gear valve. (NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction.)	Replace valve.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Momentary increase in effort when turning wheel fast to right or left.	Low fluid level in pump.	Add power steering fluid as required.
	Pump belt slipping.	Tighten or replace belt.
	High internal leakage.	Check pump pressure. (See pump pressure test).
Steering wheel surges or jerks when turning with engine running especially during parking.	Low fluid level.	Fill as required.
	Loose pump belt.	Adjust tension to specification.
	Steering linkage hitting engine oil pan at full turn.	Correct clearance.
	Insufficient pump pressure.	Check pump pressure. (See pump pressure test). Replace relief valve if defective.
	Sticky flow control valve.	Inspect for varnish or damage, replace if necessary.
Excessive wheel kickback or loose steering.	Air in system.	Add power steering fluid to pump reservoir and bleed by operating steering. Check hose connectors for proper torque and adjust as required.
	Steering gear loose on frame.	Tighten attaching screws to specified torque.
	Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose.	Tighten flange pinch bolts to specified torque, if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque.
	Steering linkage joints worn enough to be loose.	Replace loose pivots.
	Front wheel bearings incorrectly adjusted or worn.	Adjust bearings or replace with new parts as necessary.
	Worn poppet valve (Gear).	Replace poppet valve.
	Loose thrust bearing preload adjustment. (Gear)	Adjust to specification with gear out of vehicle.
	Excessive "over-center" lash.	Adjust to specification with gear out of vehicle.
Hard steering or lack of assist. (NOTE: If previous checks do not reveal cause of hard steering, follow the procedure below to determine fault.)	Loose pump belt.	Adjust belt tension to specification.
	Low fluid level in reservoir. (NOTE: Low fluid level will also result in excessive pump noise.)	Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors to specified torque.
	Steering gear to column misalignment.	Align steering column.
	Lower coupling flange rubbing against steering gear adjuster plug.	Loosen pinch bolt and assemble properly.
	Tires not properly inflated.	Inflate to recommended pressure.
	Further possible causes could be: Sticky flow control valve. Insufficient pump pressure out put. Excessive internal pump leakage. Excessive internal gear leakage.	In order to diagnose conditions listed below, a test of the entire power steering system is required.

STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Foaming milky power steering fluid, low fluid level, and possible low pressure.	Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
Low pressure due to steering pump.	Flow control valve stuck or inoperative.	Remove burrs or dirt or replace.
	Pressure plate not flat against cam ring.	Correct.
	Extreme wear of cam ring.	Replace parts. Disassemble gear and clean. Flush hoses.
	Scored pressure plate, thrust plate or rotor.	Replace parts (If rotor, replace with rotating group kit), disassemble gear and clean.
	Vanes not installed properly.	Install properly.
	Vanes sticking in rotor slots.	Free-up by removing burrs, varnish or dirt.
	Cracked or broken thrust or pressure plate.	Replace part.
Low pressure due to steering gear.	Pressure loss in cylinder due to worn piston ring or scored housing bore.	Remove gear from car for disassembly and inspection of ring and housing bore.
	Leakage at valve rings, valve body to worm seal.	Remove gear from car for disassembly and replace seals.

STEERING LINKAGE DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive play or looseness in steering system.	Front wheel bearings loosely adjusted.	Adjust bearings or replace with new parts as necessary.
	Worn couplings or steering shaft U-joints.	Replace.
	Worn upper spherical joints.	Replace.
	Steering wheel loose on shaft, loose pitman arm, tie rods, steering arms or steering linkage ball studs.	Tighten to specified torque.
	Steering gear worm bearings loosely adjusted.	Adjust preload to specification.
	Excessive pitman shaft or ball nut lash in steering gear.	Adjust preload(s) to specification.
	Worn intermediate rod or tie rod sockets.	Replace worn parts.
	Shock absorber soft (Eldorado only).	Replace shock absorber.
Excessive looseness in tie rod or intermediate rod pivots, or excessive vertical lash in idler support.	Seal damage and leakage resulting in loss of lubricant, corrosion and excessive wear.	Replace damaged or worn parts as necessary.
Hard Steering--Excessive effort required at steering wheel.	Low or uneven tire pressure.	Inflate to specified pressures.
	Steering linkage or spherical joints need lubrication.	Lube with specified lubricant. Check for damaged seal.
	Tight or frozen intermediate rod, tie rod or idler socket.	Lube or replace as necessary. Check for damaged seal.
	Steering gear to column misalignment.	Align column.
	Steering gear adjusted too tightly.	Adjust preload to specification.
	Front wheel alignment incorrect.	Check alignment and correct as necessary.
	Shock absorber bound up (Eldorado only).	Replace shock absorber.
Poor returnability.	Steering linkage or spherical joints need lubrication.	Lube with specified lubricant.
	Steering gear adjusted too tightly.	Adjust preload to specifications.
	Front wheel alignment incorrect.	Check alignment and correct as necessary.
	Steering gear to column misalignment.	Align column.

STANDARD COLUMN DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Will not unlock.	Sector collapsed. Lock bolt damaged. Defective lock cylinder. Damaged housing.	Replace sector. Replace lock bolt. Replace lock cylinder. Replace housing.
Will not lock.	Lock bolt spring broken or defective. Damaged sector tooth. Defective lock cylinder. Burr on lock bolt or housing. Damaged housing. Transmission linkage adjustment incorrect. Sector installed incorrectly.	Replace lock bolt spring. Replace sector. Replace lock cylinder. Remove burr. Replace housing. Readjust. Install correctly.
High effort.	Lock cylinder defective. Ignition switch defective. Rack preload spring broken or deformed. Burrs on sector, rack or housing. Bent sector shaft. Actuator rod restricted.	Replace lock cylinder. Replace ignition switch. Replace rack preload spring. Remove burr. Replace housing assembly. Remove restriction.
High effort on lock cylinder between "off" and "off-lock".	Burr on tang of shift gate. Distorted rack.	Remove burr. Replace rack.
Will stick in "start".	Actuator rod deformed. Any high effort condition. Ignition switch defective.	Straighten or replace. Check items under high effort section. Replace switch.
Lock bolt hits shaft lock in "off" position and "park".	Ignition switch is not set correctly.	Readjust ignition switch.
Key cannot be removed in "off-lock".	Ignition switch is not set correctly. Defective lock cylinder.	Readjust. Replace lock cylinder.
Lock cylinder can be removed without depressing retainer.	Lock cylinder with defective retainer. Lock cylinder without retainer. Burr over retainer slot in housing.	Replace lock cylinder. Replace lock cylinder. Remove burr in housing.

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
	IGNITION SYSTEM	
Electrical system will not function.	Defective fuse in "accessory" circuit.	Replace fuse.
	Connector body loose or defective.	Tighten or replace.
	Defective wiring.	Repair or replace.
	Defective ignition switch.	Replace ignition switch.
Switch will not actuate mechanically.	Defective ignition switch.	Replace ignition switch. NOTE: Follow installation procedure outlined on label attached to column.
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace switch actuator rod.
Noise in column.	Coupling bolts not tightened.	Tighten pinch bolts to specified torque.
		Tighten coupling bolts to specified torque. (Parts should be inspected for damage before reassembling. If serrations or threads are damaged, replace parts).
	Coupling pulled apart.	Realign column and replace coupling.
		Broken shaft plastic injected joint. If shaft is damaged, replace -- if not, repair joint using steering shaft repair kit.
	Horn contact ring not lubricated.	Lubricate with lubriplate or equivalent.
	Lack of grease on bearings or bearing surface.	Lubricate.
	Lower shaft bearing tight or frozen.	Replace bearing. Check shaft and replace if scored.
	Upper shaft bearing tight or frozen.	Replace housing assembly.
	Shaft lock plate cover loose.	Tighten three screws to specified torque or, if missing, replace. *CAUTION: Use specified screws only.*
	Lock plate retaining ring not seated.	Replace retaining ring. Check for proper seating in groove.
	Shaft lock plate cover loose.	Tighten three screws.

Method to Determine Column Collapse

Measure distance between top of neutral-start switch window opening and the bottom of the upper jacket. The correct dimension is 5 11/16" - 5 1/2".

STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
One click when in "off-lock" position and the steering wheel is moved.		None - normal -- lock bolt is seating.
High steering shaft turning effort.	Column assembly misaligned in vehicle.	Align correctly.
	Improperly installed or deformed dust seal.	Replace dust seal.
	Tight or frozen upper or lower bearings.	Replace.
	"E" car only.	Replace U-Joint
	U-Joint binding.	
High shift effort.	Column not aligned correctly in car.	Realign
	Lower bowl bearing not assembled correctly.	Reassemble correctly.
	Improperly installed dust seal.	Remove and replace.
	Lack of grease on seal or bearing areas.	Lubricate.
Improper transmission shifting.	Sheared shift tube joint.	Replace shift tube assembly.
	Improper transmission linkage adjustment.	Readjust.
	Improper gate plate.	Replace with correct part.
Miscellaneous.	Shroud loose on shift bowl.	Bend tabs on shroud over lugs on bowl.
	Housing loose on jacket -- will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	Tighten four mounting screws to specified torque.
Lash in mounted column assembly.	IP to dash mounting bolts loose.	Tighten to specified torque.
	Broken weld nuts on jacket.	Replace jacket assembly.
	IP bracket capsule sheared.	Replace bracket assembly.
	IP to jacket mounting bolts loose.	Tighten to specified torque.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Will not unlock.	Shear flange on sector shaft collapsed.	Replace sector.
	Lock bolt damaged.	Replace lock bolt.
	Defective lock cylinder.	Replace lock cylinder.
	Damaged housing.	Replace housing.
	Damaged sector.	Replace sector.
	Damaged rack.	Replace rack.
Will not lock.	Lock bolt spring broken or defective.	Replace lock bolt spring.
	Damaged sector tooth.	Replace sector.
	Defective lock cylinder.	Replace lock cylinder.
	Burr on lock bolt or housing.	Remove burr.
	Damaged housing.	Replace housing.
	Transmission linkage adjustment incorrect.	Readjust.
	Damaged rack.	Replace rack.
	Interference between bowl and rack coupling.	Replace bowl or actuator rod as required.
	Ignition switch stuck.	Replace ignition switch.
	Actuator rod restricted.	Readjust.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
High effort.	Lock cylinder defective.	Replace lock cylinder.
	Ignition switch defective.	Replace ignition switch.
	Rack preload spring broken or deformed.	Replace preload spring.
	Burrs on sector, rack, housing, support or actuator rod coupling.	Remove burr.
	Bent sector shaft.	Replace shaft.
	Defective rack.	Replace rack.
	Extreme misalignment of housing to cover.	Replace either or both.
	Distorted coupling slot in rack.	Replace rack.
	Bent actuator rod.	Straighten or replace.
	Ignition switch mounting bracket bent.	Straighten or replace.
Will stick in "start".	Actuator rod deformed.	Straighten or replace.
	Any high effort condition.	Check items under high effort section.
	Ignition switch defective.	Replace switch.
Key cannot be removed in "off-lock".	Ignition switch is not adjusted correctly.	Readjust
	Defective lock cylinder.	Replace lock cylinder.
Lock cylinder can be removed without depressing retainer.	Lock cylinder with defective retainer.	Replace lock cylinder.
	Lock cylinder without retainer.	Replace lock cylinder.
	Burr over retainer slot in housing cover.	Remove burr.
	IGNITION SYSTEM	
Electrical system will not function.	Poor battery connection.	Connect securely.
	Connector body loose or defective.	Tighten or replace.
	Defective wiring.	Repair or replace.
	Defective ignition switch.	Replace ignition switch.
	Ignition switch not adjusted properly.	Readjust.
Switch will not actuate mechanically.	Defective ignition switch.	Replace.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace.
	Sector to rack engaged in wrong tooth.	Engage correctly.
	COLUMN	
Noise in column.	Coupling bolts not tightened.	Tighten pinch bolts to specified torque.
	Column not correctly aligned.	Realign column.
	Coupling pulled apart.	Realign column and replace coupling.
	Broken steering shaft plastic injected joint.	Repair joint using steering shaft repair kit and realign column.
	Horn contact ring not lubricated.	Lubricate with lubriplate or equivalent.
	Lack of grease on bearings or bearing surfaces.	Lubricate
	Loose tilt lever opening shields.	Bend to eliminate rattle.
	Lower shaft bearing worn or broken.	Replace bearing.
		Check shaft and replace if scored.
	Upper shaft bearing worn or broken.	Replace bearing assembly.
	One click when in "off-lock" position and the steering wheel is moved.	Normal -- lock bolt is seating.
High steering shaft effort.	Column assembly misaligned.	Realign.
	Improperly installed or deformed dust seal.	Install new seal.
	Defective upper or lower bearing.	Replace.
	Flashing on I.D. of shift tube from plastic joint.	Replace shift tube.
	Tight steering universal joint. Eldorado only.	Repair or replace.
High shift effort.	Column not aligned correctly in car.	Realign.
	Wave washer with burrs.	Replace.
	Improperly installed dust seal.	Remove and replace.
	Lack of grease on seal or bearing.	Lubricate.
	Improper screws used for ignition switch, neutral start switch or mounting bracket.	Use correct fasteners.
	Burr on upper or lower end of shift tube.	Remove burr.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Improper transmission shifting.	Sheared shift tube joint or lower shift lever weld. Improper transmission linkage adjustment.	Replace tube assembly. Readjust.
Miscellaneous.	Housing loose on jacket -- will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	Tighten four mounting screws to specified torque.
Lash in mounted column assembly.	IP to dash mounting bolts loose. Broken weld nuts on jacket. IP bracket capsule sheared. Loose shoes in housing. Loose tilt head pivot pins. Loose shoe lock pin in support. Loose support screws.	Tighten to specified torque. Replace jacket assembly. Replace bracket assembly. Replace shoes. Replace pivot pins. Replace pin. Tighten to specified torque.
Housing scraping on bowl.	Bowl bent or not concentric with hub.	Replace bowl.
Steering wheel loose.	Wheel loose on shaft. Defective or missing anti-lash spring in spheres. Upper bearing not seating in bearing race. Upper bearing inner race seat missing. Improperly adjust T & T locking lever. Loose support screws. Bearing preload spring missing or broken.	Tighten nut to specified torque. Add spring or replace both. Replace both. Install seat. Readjust. Tighten to specified torque. Replace preload spring.
Steering wheel loose -- every other tilt position.	Loose fit between shoe and shoe pivot pin.	Replace both.
Steering column not locking in any tilt position.	Shoe seized on its pivot pin. Shoe grooves may have burrs or dirt. Shoe lock spring weak or broken.	Replace both. Replace shoe. Replace lock spring.

TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Steering wheel fails to return to top tilt position.	Pivot pins are bound up. Wheel tilt spring is defective. Turn signal switch wires too tight.	Replace pivot pins. Replace tilt spring. Readjust.
Noise when tilting column.	Upper tilt bumpers worn. Tilt spring rubbing in housing.	Replace tilt bumper. Lubricate.

Method to Determine Column Collapse

Measure distance between top of neutral-start switch window opening and the bottom of the upper jacket. The correct dimension is 5 11/16" - 5 1/2".

TURN SIGNAL SWITCH DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Turn signal will not cancel.	Loose switch mounting screws.	Tighten to specified torque.
	Switch or anchor bosses broken.	Replace switch.
	Broken, missing or out of position detent, return or cancelling spring.	Reposition or replace spring as required.
	Uneven or incorrect cancelling cam to cancelling spring interference.	Adjust switch position: If interference is correct and switch will still not cancel, replace switch. If interference cannot be corrected by switch adjustment, replace cancelling cam.
Turn signal difficult to operate.	Actuator rod loose.	Tighten to specified torque.
	Yoke broken or distorted.	Replace switch.
	Loose or misplaced springs.	Reposition or replace springs.
	Foreign parts and/or material.	Remove foreign parts and/or material.
	Switch mounted loosely.	Tighten mounting screws to specified torque.
Turn signal will not indicate lane change.	Broken lane change pressure pad or spring hanger.	Replace switch.
	Broken, missing or misplaced lane change spring.	Replace or reposition as required.
	Jammed base or wires.	Loosen mounting screws, reposition base or wires and retighten screws to specified torque.

TURN SIGNAL SWITCH DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Turn signal will not stay in turn position.	Foreign material or loose parts impeding movement of yoke.	Remove material and/or parts.
	Broken or missing detent or cancelling spring.	Replace spring.
	None of the above.	Replace switch.
Hazard switch cannot be turned off.	Foreign material between hazard support cancelling leg and yoke.	Remove foreign material.
		No foreign material impeding function of hazard switch -- replace turn signal switch.
Hazard switch will not stay on or difficult to turn off.	Loose switch mounting screws.	Tighten mounting screws to specified torque.
	Interference with other components.	Remove interference.
	Foreign material.	Remove foreign material.
	None of the above.	Replace switch.
	Actuating lever not installed properly.	Reinstall switch and lever assembly.
No turn signal lights.	Defective or blown fuse.	Replace fuse.
	Inoperative turn signal flasher.	Replace turn signal flasher. (Note: There are two flashers in the system.)
	Loose chassis to column connector.	Connect securely.
	Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand.	
	If vehicle lights now operate normally, signal switch is inoperative.	Replace signal switch.
	If vehicle lights do not operate, check chassis wiring for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.
Turn indicator lights on, but not flashing.	Inoperative turn flasher.	Replace turn flasher. (Note: There are two flashers in system.)
	Loose chassis to column connection.	Connect securely.
	Inoperative turn signal switch.	Replace turn signal switch.
	To determine if turn signal switch is defective, substitute new switch into circuit and operate switch by hand.	
	If the vehicle's lights operate normally, signal switch is inoperative.	Replace signal switch.
	If the vehicle's lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.

TURN SIGNAL SWITCH DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Front or rear turn signal lights not flashing.	Burned out fuse.	Replace fuse.
	Burned out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Remove or repair defective connection.
	Loose chassis to column connector.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system and operate switch by hand.	
	If turn signal lights are now on and flash, turn signal switch is inoperative.	Replace turn signal switch.
	If vehicle lights do not operate, check chassis wiring harness to light sockets for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.
Stop light not on when turn indicated.	Burned out fuse.	Replace fuse.
	Loose column to chassis connection.	Connect securely.
	Disconnect column to chassis connector.	
	Connect new switch into system without removing old.	
	Operate switch by hand.	
	If brake lights work with switch in the turn position, signal switch is defective.	Replace signal switch.
	If brake lights do not work, check connector to stop light, sockets, for grounds, open, etc.	Repair connector to stop light circuits using manual as guide.
Turn indicator panel lights not flashing.	Burned out bulbs.	Replace bulbs.
	High resistance to ground at bulb socket.	Replace socket.
	Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights.	Locate and repair as required. Use shop manual as guide.
Turn signal lights flash very slowly.	Inoperative turn signal flasher.	Replace turn signal flasher.
	System charging voltage low.	Increase voltage to specified. Use manual.
	High resistance ground at light sockets.	Repair high resistance grounds at light sockets.
	Loose chassis to column connection.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system without removing old.	
	Operate switch by hand. If flashing occurs at normal rate, the signal switch is defective.	Replace signal switch.

TURN SIGNAL SWITCH DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Turn signal lights flash very slowly. (Cont'd.)	If the flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for grounds, high resistance points, etc.	Locate and repair as required. Use manual as guide.
Hazard signal lights will not flash -- turn signal functions normally.	Blown fuse.	Replace fuse.
	Inoperative hazard warning flasher.	Replace hazard warning flasher.
	Loose chassis to column connection.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system without removing old.	
	Depress the hazard warning button and observe the hazard warning lights. If they now work normally, the turn signal switch is defective.	Replace the turn signal switch.
	If the lights do not flash, check wiring harness for open between hazard flasher and harmonica connector. If open, fuse block is defective.	Replace fuse block.

KEY BUZZER DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound with key fully inserted in lock cylinder with the driver's door open.	Defective buzzer.	Replace buzzer.
	Bad connection at buzzer.	Connect securely.
	Power not available to buzzer.	Check continuity of chassis wiring and repair as required.
	Horn relay inoperative.	Check by grounding #4 terminal on horn relay, if buzzer does not sound, replace horn relay.
	Door jamb switch on driver's side misadjusted or inoperative.	Adjust or replace -- as required.
	Short in chassis wiring.	Check by separating chassis to column connector. Connect (black) and (black w/pink stripe) female contacts on the chassis side. Bent paper clip will work if buzzer sounds, continue diagnosis. If not, locate and repair chassis wiring.

(Note 1: If the buzzer fault has not yet been detected, connect a continuity meter (light) to the male #E & #F connector contacts of the turn signal switch connector (Fig. 9-82). Insert the key the full depth into the lock cylinder.)

If contact is made with the key in, and is not made with it out, the function is normal. Retrace initial diagnostic steps.

If contact is not established, the fault is in the column. Proceed to Note 2.

(Note 2: With the fault isolated in the column, disassemble the upper end of the column until the signal switch mounting screws have been removed. Lift the switch and check the probes of the buzzer switch to insure good contact with the pads on the signal switch. Bend probes, if required, then reseat the signal switch and install the three screws. Check the function, as in Note 1.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound, cont'd.	Short or fault in signal switch wiring.	Check wiring by connecting continuity meter on "E" terminal of connector and turn signal switch, buzzer switch pad with black wire attached and "F" terminal to pad with pink wire attached. If contact is made, function is normal. If not, replace signal switch.

(Note 3: If the buzzer has not yet been isolated and repaired, connect a continuity meter to the buzzer switch electrical contact probes. Fully insert and remove the key from the lock cylinder.)

If contact is made with the key in, and is broken with it out, the function is normal. Retrace diagnostic steps starting at Note 2.

If contact is not made, the fault is in the lock cylinder or buzzer switch.

KEY BUZZER DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound cont'd.	Chips, burrs, foreign material preventing actuator tip function. *CAUTION: Key must be removed or cylinder in "run" position before removing lock cylinder.*	Remove chips, burrs, etc. Reassemble and recheck ref. note 3.
	Defective lock cylinder.	With the lock cylinder out (observing caution above), fully insert and remove the key. The actuator should extend and retract smoothly.
	Chips, foreign material affecting buzzer switch operation.	Remove and clean as required -- reassemble and re-check per note 3.
	Damaged or broken buzzer switch.	Replace buzzer switch.
	Switch appears good but will not make contact.	Connect continuity meter leads to the buzzer switch probes, Fig. 9-82. Press on the actuator pad until the interior points contact. If contact is not made, replace buzzer switch.
	Buzzer switch contact gap too large.	Reset contact gap.

(Note 4: Setting the contact gap, (Fig. 9-82). Press a .030 wire type spark plug gap wire with flat piece of stock on the actuator pad.)

If contact is not made adjust switch as shown until positive contact is made. (Use continuity meter).

With positive contact at .030, use a .025 plug gap wire beneath the flat stock. No contact should occur. Adjust as shown in (Fig. 9-82). When the switch will make contact with the .030 wire, and not with the .025, the buzzer switch is set at the low limit.

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer continues to operate with key in the lock cylinder with the driver's door either opened or closed and ceases when key is removed.	Door jamb switch on driver's side misadjusted or inoperative.	Adjust or replace as required.
	Wire from signal switch to door jamb switch shorted.	If on signal switch side, replace signal switch. If on chassis side, find and repair-use manual.

(Note 5: This condition indicates the lock cylinder or buzzer switch is at fault. To verify, check for continuity at the "E" & "F" male connector contacts with the key removed from the lock cylinder, (Fig. 9-82). If continuity exists, the fault is in the column.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer continues to operate with key out, but stops when driver's door is closed.	Turn lock towards start position. If buzzer stops in "Run" position or when turned past "Run" towards "Start" the problem is a sticky lock cylinder actuator.	Replace lock cylinder.
	Chips, foreign material in lock cylinder bore.	Remove, reassemble and recheck function.
	Sticky lock cylinder actuator tip.	Replace lock cylinder.
	Damaged or broken buzzer-switch.	Replace buzzer switch.
	Buzzer switch contact gap too close.	Adjust as specified.

SERVICE INFORMATION

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology *See CAUTION on page 9-28.*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Fluid Level

(NOTE: When making a complete fluid change, always use special power steering fluid available from servicing parts warehouses. When topping off the fluid, if the special fluid is not available. Dexron ® Automatic Transmission Fluid or equivalent may be used.)

1. Run engine and turn gear from lock to lock three or four times, then shut engine off with gear in left turn position. Remove reservoir filler cap and check oil level on dipstick. Level should be halfway between "hot" and "cold" marks when fluid is approximately 150 degrees (reservoir is hot to touch).

2. If oil level when hot (approximately 150°) is below "cold" mark add special power steering fluid until level is halfway between the "hot" and "cold" marks on dipstick and reinstall filler cap.

(NOTE: At room temperature (approximately 70°) or before starting the engine, the fluid level should be between the "cold" and "add" marks on the dipstick. After high speed driving under high ambient conditions, fluid will be at the "hot" mark at approximately 250° fluid temperature.)

3. When checking fluid level after making a complete fluid change, air must be bled from the system. Proceed as follows:

a. Install fluid in system. Fluid level in the pump must be at base of reservoir neck.

b. Raise front of car and with engine off, turn wheels all the way to the left.

c. Add power steering fluid to "Add" mark on dipstick.

d. Crank engine for one second or less without starting engine.

e. Add fluid if necessary to "Add" mark on dipstick.

f. Start engine and recheck fluid level. Add fluid if necessary to "Add" mark on dipstick.

g. Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above internal pump casting. Fluid with air in it will have a light tan appearance. This air must be eliminated from fluid before normal steering action can be obtained.

h. Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

i. Road test car to make sure steering functions normally and is free from noise.

j. Recheck fluid level as described in step 1 making sure fluid is at the specified level.

2. Checking Pump Pressure

1. Disconnect pressure hose at union of pump, use a small container to catch any fluid which might leak.

2. Connect a spare pressure hose to pump union. A 1969 or 1970 hose may be more convenient than current production.

3. Using pressure gage, J-5176-1, adapter fitting, J-22326, connect gage to both hoses.

4. Open hand valve on gage.

5. Start engine, allow system to reach operating temperatures and check fluid level adding any fluid if required. When engine is at normal operating temperature, the initial pressure read on the gage (valve open) should be in the 80-125 PSI range. Should this pressure be in excess of 200 PSI, check the hoses for restrictions and the poppet valve for proper assembly.

6. Close gate valve fully three times. Record the highest pressures attained each time.

CAUTION: Do not leave valve fully closed for more than five seconds as the pump could be damaged internally.

7. If the pressures recorded are between 1425-1450 PSI and the range of readings are within 30 PSI, the pump is functioning within specifications.

8. If the pressures recorded are high, but do not repeat within 30 psi, the flow controlling valve is sticking. Remove the valve, clean it and remove any burrs using crocus cloth or fine hone. If the system contains some dirt, flush it. If it is exceptionally dirty, both the pump and the gear must be completely disassembled, cleaned and reassembled before further usage.

9. If the pressures recorded are constant, but below the low listed specification, replace the flow control valve and recheck. If the pressures are still low, replace the rotating group.

10. If the pump checks to specification, leave the valve open and turn (or have turned) the steering wheel into both corners. Record the highest pressures and compare with the maximum pump pressure recorded. If this pressure cannot be built in either (or one) side of the gear, and is below specification, the gear is leaking internally and must be disassembled and repaired.

11 Shut off engine, remove testing gage, spare hose, reconnect pressure hose, check fluid level or make needed repairs. Run engine and recheck fluid level as outlined in Note 1.

WARNING: WHEN HOSES ARE RECONNECTED ON ELDORADO BE SURE HOSES DO NOT TOUCH WHEEL HOUSING, AIR SILENCER OR BRACKET AS HOSES MAY BECOME CHAFED AND RUPTURE.

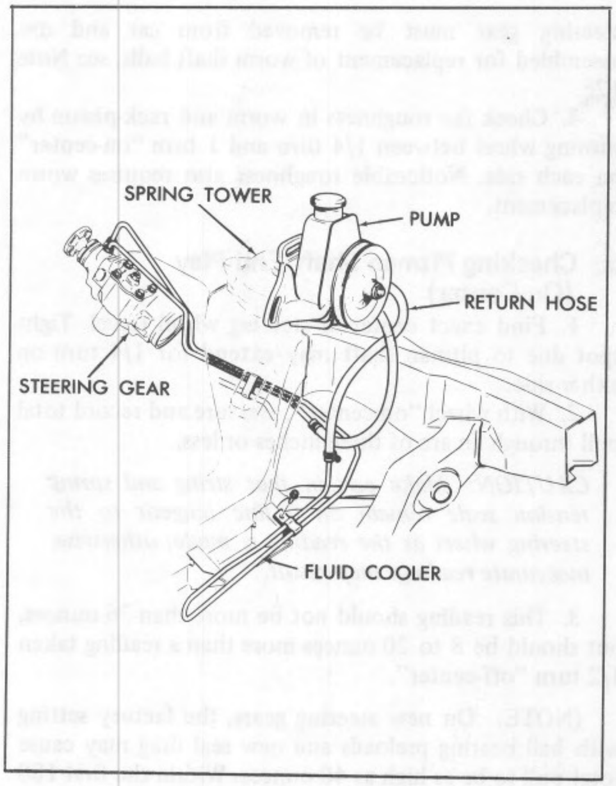


Fig. 9-18 Steering Pump Fluid Cooler Location

3. Steering Pump Fluid Cooler Tube (Fig. 9-18)

a. Removal

1. Position container under fluid cooler to catch fluid that will escape when hose and clamp are removed.

2. Remove clamp securing return hose to fluid cooler tube and position hose to prevent further leakage of fluid.

3. Separate return line from gear and plug opening at gear to prevent loss of fluid and entrance of dirt into system.

4. Remove screws and clips securing cooler tube to frame center bracket and underside of frame cross member.

(NOTE: Eldorado cooler is secured to the bottom of the cradle support.)

b. Installation

1. Position new cooler tube, remove plug in gear and connect new cooler. Tighten nut finger tight.

2. Secure cooler to frame center bracket and underside of frame cross member. (Eldorado is fastened to bottom of cradle support.) Tighten mounting screws to 11 foot-pounds.

3. Tighten nut to gear to 30 foot-pounds.

4. Install hose on return line and on longest end of "Trombone" and secure each end with clamp, tighten to 20 inch-pounds.

5. Bleed and refill steering system with power steering fluid, following procedure of Note 1.

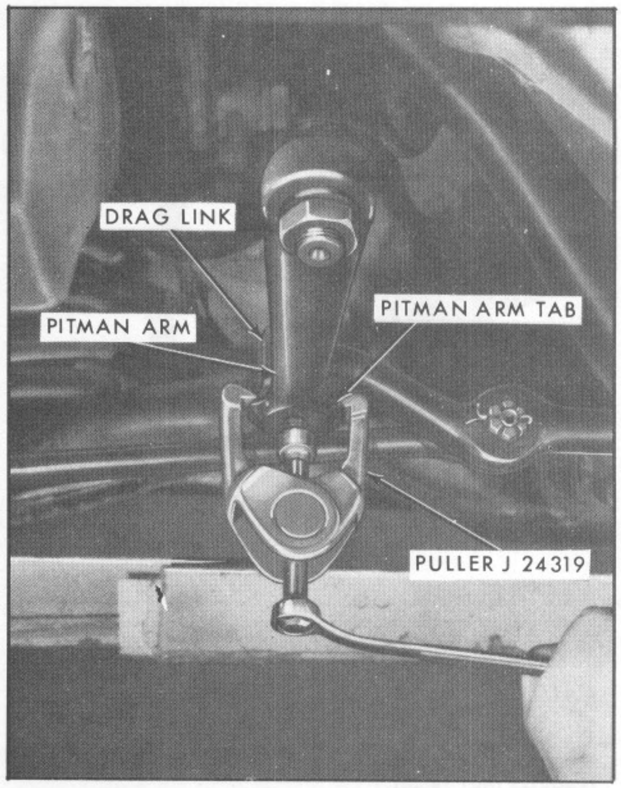


Fig. 9-19 Disconnecting Pitman Arm

4. Checking Steering Gear Adjustments—On Car

Before making adjustments to the power steering gear to correct conditions such as shimmy, hard or loose steering, road shock, wander, or weave, a check should be made of front end alignment, shock absorbers, wheel balance, tire pressure or for tight front wheel bearings, loose steering rod ends, or loose pitman arm.

When steering gear is thought to be out of adjustment, a quick check can be made by moving steering wheel back and forth with short slow motions at the "on center" position with engine off. Excessive looseness felt or heard indicates that either the pitman shaft or the thrust bearing requires adjustment. These adjustments can be made on car with engine off as follows:

a. Thrust Bearing Preload Check (Just Away From the Stops)

1. Remove pitman arm from drag link, using Puller Tool J-24319, Fig. 9-19. Make certain tool is positioned with puller engaging tabs on pitman arm. On Eldorado, disconnect pitman arm from drag link as described in Note 32, steps 2, 3 and 4.

2. Check for any distortion or binding in flexible coupling. Correct as necessary, see Note 6.

3. Turn steering wheel just away from stops, and use a spring tension scale with a piece of string to measure pull on steering wheel through an arc not exceeding one inch, Fig. 9-20. Total pull should be between 4 and 12 ounces (thrust bearing and friction).

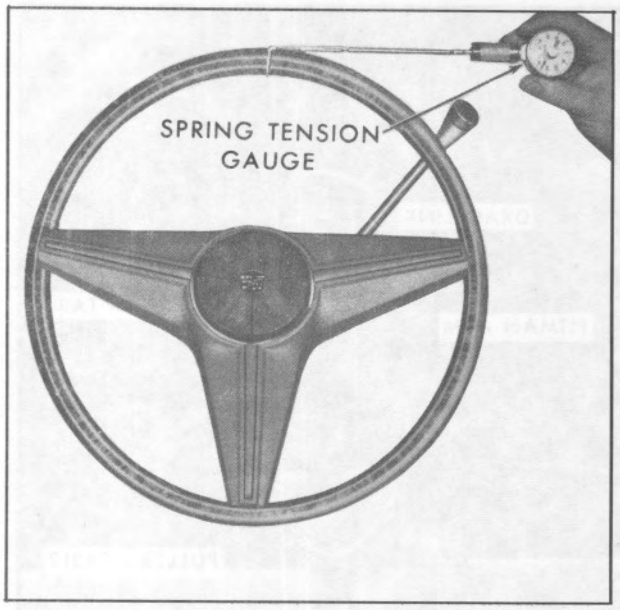


Fig. 9-20 Checking Steering Wheel Pull

CAUTION: Make certain string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise, inaccurate readings may result.

4. If pull is greater or less than specified, loosen adjuster plug locknut and back off adjuster plug 1/8 turn, using Spanner Wrench J-7624.

(NOTE: If position of holes in adjuster plug is such that there is insufficient clearance for using Spanner Wrench, insert a #10 bolt 3/4 inch long in one of the adjuster plug holes and rotate flexible coupling until lower flange contacts bolt. Then back off adjuster plug 1/8 turn.)

5. Recheck steering "pull" with wheel just away from the stops.

6. Adjust preload by tightening adjuster plug to obtain 2 to 6 ounces (at rim of steering wheel) in excess of total drag that was just measured with adjuster plug backed-off 1/8 turn.

7. Tighten adjuster plug locknut and recheck preload to insure that plug did not move when nut was tightened.

b. Checking Worm and Ball Preload (1/2 Turn Off-Center)

1. Locate center of steering wheel travel and turn wheel 1/2 turn "off-center".

2. With wheel 1/2 turn "off-center", measure and record total pull through an arc not exceeding one inch. Due to worm and ball preload, the total pull should be from 2 to 8 ounces in excess of the pull just away from the stop previously recorded.

CAUTION: Make certain that string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise inaccurate readings may result.

3. If total pull is less than one ounce or more than 9 ounces in excess pull, with wheel just away from stop, steering gear must be removed from car and disassembled for replacement of worm shaft balls, see Note 12e.

4. Check for roughness in worm and rack-piston by turning wheel between 1/4 turn and 1 turn "on-center" on each side. Noticeable roughness also requires worm replacement.

c. Checking Pitman Shaft End Play (On-Center)

1. Find exact center of steering wheel travel. Tight spot due to pitman shaft may extend for 1/4 turn on either side.

2. With wheel "on-center", measure and record total pull through an arc of three inches or less.

CAUTION: Make certain that string and spring tension scale remain on a line tangent to the steering wheel as the reading is made; otherwise, inaccurate readings may result.

3. This reading should not be more than 36 ounces, but should be 8 to 20 ounces more than a reading taken 1/2 turn "off-center".

(NOTE: On new steering gears, the factory setting with ball bearing preloads and new seal drag may cause total pull to be as high as 40 ounces. Within the first 100 miles of operation, the seals seat themselves and the ball bearings polish the rack-piston and worm shaft grooves sufficiently to meet the service specifications.)

4. If pitman shaft end play is not within limits, it should be adjusted so that "on-center" preload is 16-18 ounces more than the 1/2 turn "off-center" load but still not more than 36 ounces. Adjust on car by loosening locknut and turning adjusting screw as required. Recheck pull. Tighten locknut, cycle steering wheel full left to full right turn twice and recheck.

5. When steering gear adjustments are completed, remove spring scale, connect pitman arm to drag link, and tighten drag link nut to 45 foot-pounds. Install cotter pin securing drag link nut. On Eldorado, connect pitman arm to drag link as described in Note 32d.

See CAUTION on Page 9-28.

5. Steering Linkage Parallelism—Except Eldorado (Fig. 9-21)

Drag link height and parallelism should be checked in cases of steering wander and instability after normal correcting adjustments such as standing height, front wheel alignment, etc., have been made. Check drag link height by measuring distance between lower edge of drag link, just inboard of tie rod inner pivots, and centerline of lower control arm inner pivot bolts. The procedure outlined below may be used to measure these distances:

1. Position car on wheel alignment machine and place a straight edge midway between drag link and lower control arm front inner pivots across a level parallel surface, see Fig. 9-21.

2. Measure distance "A" from centerline of control arm pivots to top of straight edge.

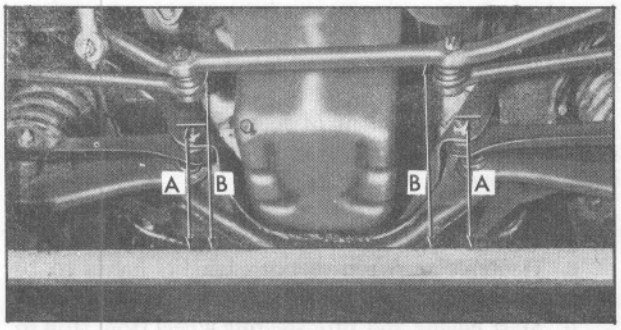


Fig. 9-21 Steering Linkage Parallelism (Except Eldorado)

3. Measure distance "B" from drag link (just inboard of inner pivots) to top of straight edge.

4. Distance "A" minus distance "B" should be equal at both inner pivot points within 1/8" for proper parallelism.

5. Vertical adjustment can be made by loosening idler arm support mounting screws on frame side bar and moving arm support to obtain proper height. (Tighten mounting screws to 35 foot-pounds) or loosening steering gear mounting bolts and moving gear to obtain proper height. (Tighten steering gear mounting bolts to 55 foot-pounds.)

See CAUTION on page 9-28.

6. Additional vertical adjustment can sometimes be obtained by tightening the pitman arm nut to a higher torque. This will move the pitman arm further onto the steering gear splined shaft.

Never loosen pitman arm nut to obtain vertical adjustment.

(NOTE: In no case should either the pitman arm or idler arm be bent to obtain the required adjustment.)

See CAUTION on page 9-28.

6. Steering Column Alignment

(NOTE: Do not raise car on hoist while aligning column as full weight of car must be on wheels for proper alignment.)

1. Start engine and position front wheels in the straight ahead position for easy access to flex-coupling adjustment screws.

2. Remove steering column lower cover as described in Section 12, Note 41.

3. Loosen screw that attaches shift cable to right hand side of column shift bowl to avoid damage to shift pointer while adjusting column.

4. Loosen two bolts that secure upper steering column mounting bracket to upper steering column support.

5. Move carpet seal up and move carpet back. Loosen six screws that secure lower steering column bracket to toe pan and one clamp screw securing lower steering column bracket to column.

6. On all cars except Eldorado, loosen one clamp

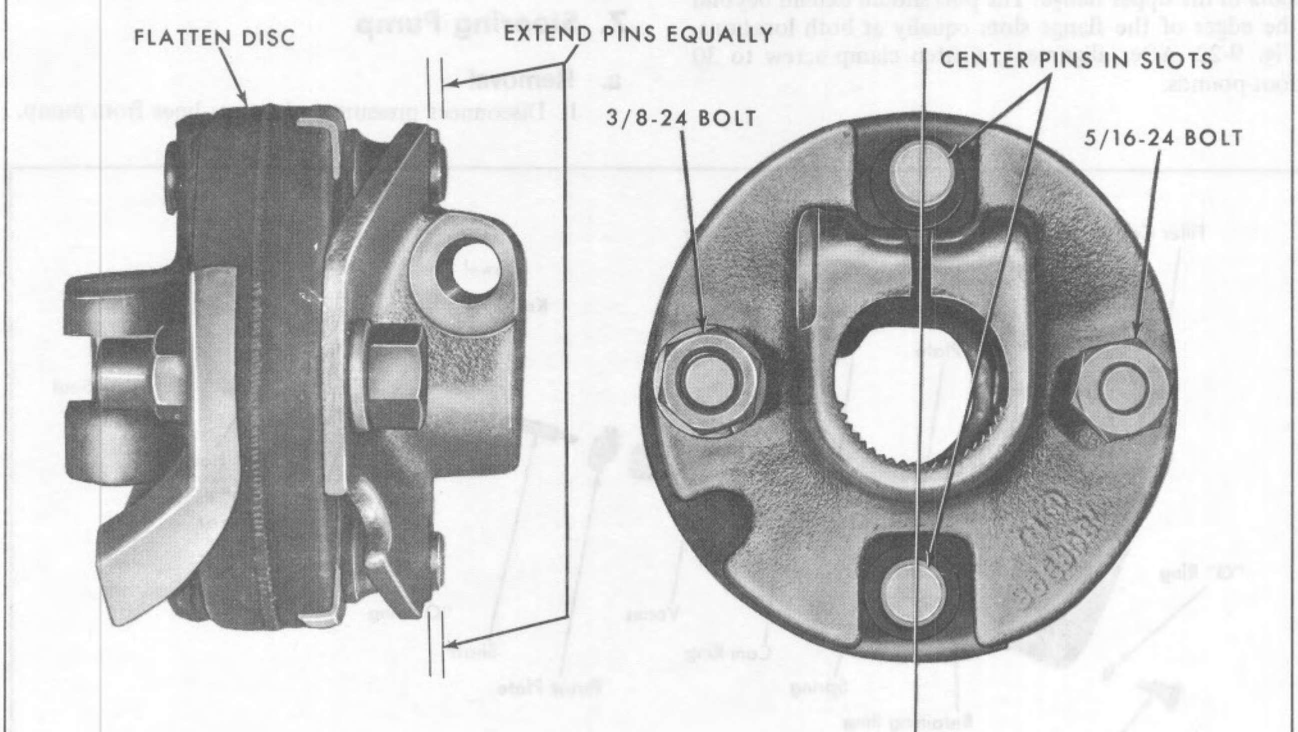


Fig. 9-22 Steering Shaft Flexible Coupling

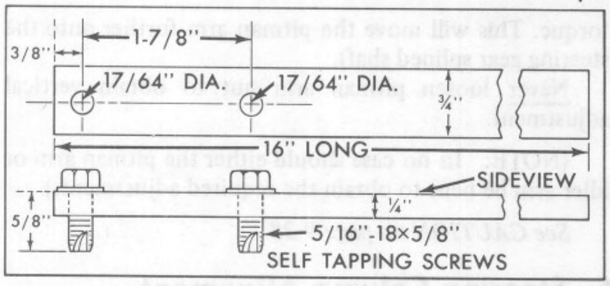


Fig. 9-23 Belt Tensioning Tool

screw that secures steering shaft to flex-coupling clamp. On Eldorado, loosen clamp screw securing steering extension shaft to universal joint clamp.

7. Align the steering column to the instrument panel as follows:

a. Adjust in and out position of column to instrument panel as described below:

Upper edge of column shift bowl (at column centerline) must be the proper distance from instrument panel bezel to have correct steering wheel to driver relationship. If working on standard column, this distance should be 4-7/16", on Tilt and Telescope column, measurement should be 2-1/4".

b. After making the above adjustment, center column within the instrument panel bezel.

Lightly torque two upper mounting brackets to support bolts.

8. Check alignment of flex-coupling disc. The steering column and gear are correctly aligned when the rubber disc is flat and the pins are centered in the "C" slots in the upper flange. The pins should extend beyond the edges of the flange slots equally at both locations, Fig. 9-22. After alignment, tighten clamp screw to 30 foot-pounds.

See CAUTION on page 9-28.

9. Install steering column lower support and make final adjustments as follows:

a. Position lower half of mounting bracket against column and lightly torque two bottommost bracket to toe pan screws.

b. Position upper half of mounting bracket and lightly torque remaining four bracket to toe pan screws.

c. Tighten clamp bolt securing bracket halves to 18 inch-pounds.

d. Start engine and turn steering wheel from stop to stop several times to neutralize position of column.

e. Tighten two upper mounting bracket to support bolts to 20-foot-pounds.

CAUTION: DO NOT exceed 20 foot-pounds as that is the maximum torque the release capsule can withstand and still provide satisfactory release.

f. Tighten all six lower mounting bracket to toe pan screws to 35 inch-pounds.

10. Adjust shift pointer and tighten attaching screw.

11. Install carpet at lower column support and position rubber carpet seal over carpet.

12. Install steering column lower cover as described in Section 12. Note 31, and recheck for proper operation of assembly. If necessary, repeat step 10.

13. Move column seal downward to cover clearance gap between bezel and shift bowl.

14. Check shift linkage for proper operation. Adjust if necessary as outlined in Section 7, Note 3, for all cars except Eldorado and Note 60 for Eldorado cars.

7. Steering Pump

a. Removal

1. Disconnect pressure and return lines from pump.

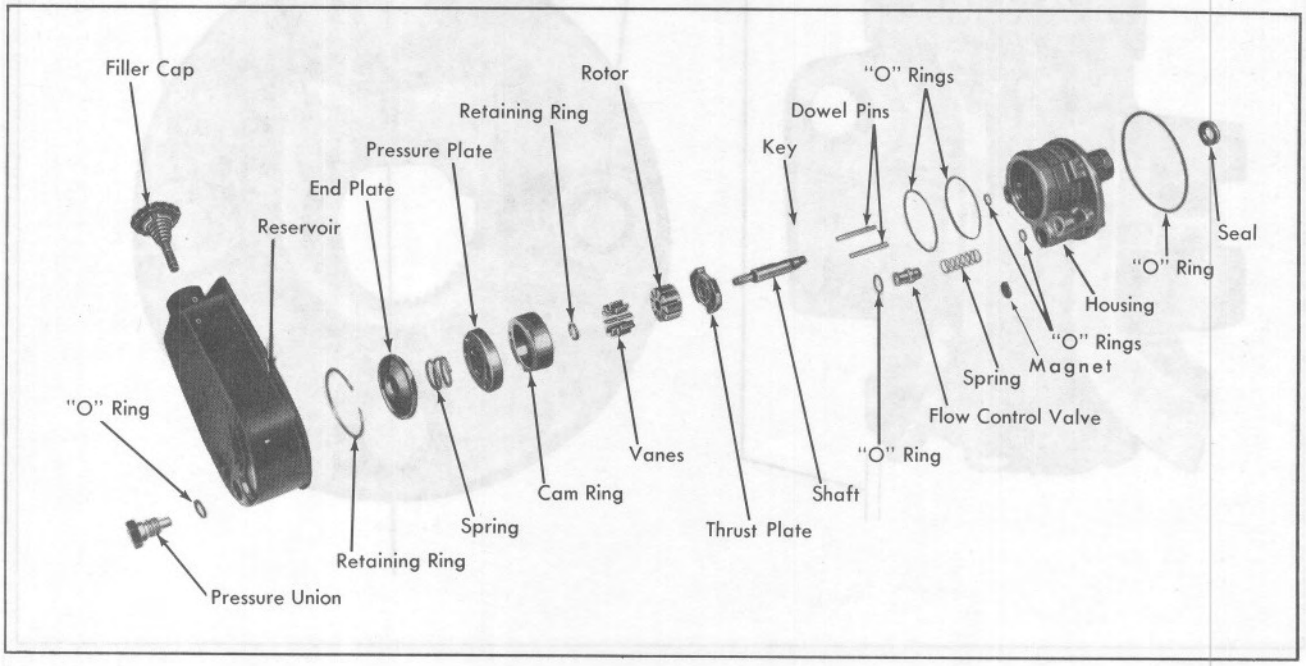


Fig. 9-24 Steering Pump Disassembled

Plug all openings to prevent loss of fluid and entrance of dirt into system.

2. Remove nut securing pump mounting bracket to cylinder head stud.

3. Remove adjusting screw securing mounting bracket to front of cylinder block.

4. Remove drive belts from pulley.

5. Remove bottom pivot screw and steering pump with bracket attached.

b. Installation

1. Position steering pump, with bracket attached, to engine and loosely install bottom pivot screw securing pump and bracket to front of cylinder block.

2. Position drive belts on pulley. Do not tension belts at this time.

3. Loosely install adjusting screw securing mounting bracket to front of cylinder block.

4. Loosely install nut securing pump mounting bracket to cylinder head stud.

5. Adjust belt tension as follows:

a. Place Belt Tension Gage, J-23600, on drive belt midway between pulleys at location B, shown in Section 6, Fig. 6-13.

b. Pull pump toward outside of car until correct belt tension is reached on belt tension gage, using the tool illustrated in Fig. 9-23, which can be made from bar steel stock and self-tapping screws. This tool fits into the accommodating holes in the front face of the pump casting behind the pulley. Do not pull or pry on pump reservoir.

(NOTE: Proper tension for a new belt is 100 lbs., and 55-70 lbs. for a belt that has been previously tensioned.)

c. Tighten all mounting and adjusting bolts and nut to 22 foot-pounds.

6. Unplug fittings and connect high pressure line at rear of pump. Tighten fitting to 40 foot-pounds.

WARNING: WHEN HOSES ARE RECONNECTED ON ELDORADO BE SURE HOSES DO NOT TOUCH WHEEL HOUSING, AIR SILENCER OR BRACKET AS HOSES MAY BECOME CHAFED AND RUPTURE.

7. Unplug fittings and install return hose on fitting at side of pump and secure with clamp. Tighten clamp to 20 inch-pounds.

8. Check fluid level as described in Note 1.

9. Bleed steering gear as described in Note 1, Step 3.

8. Steering Pump Disassembly, Cleaning and Inspection, and Assembly

a. Disassembly (Fig. 9-24)

1. Remove pulley retaining nut from shaft and then remove pump as described in Note 7A, and drain oil from pump.

2. Clamp mounting bracket in vise with pump attached.

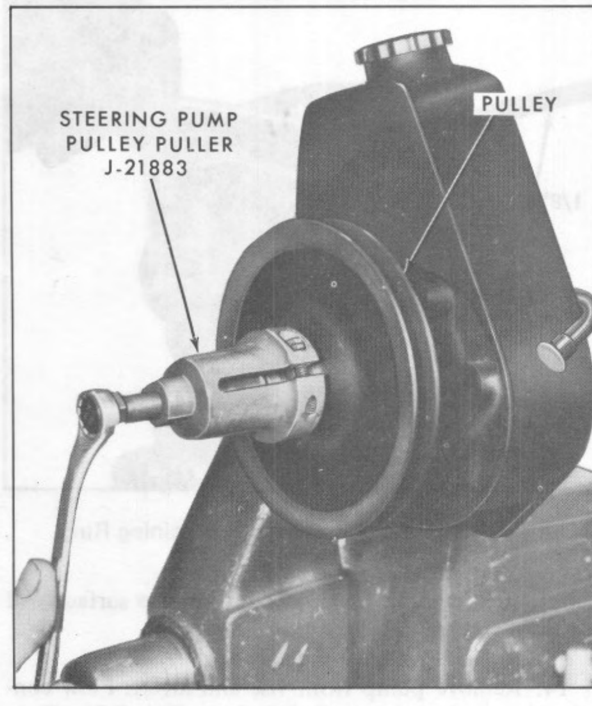


Fig. 9-25 Removing Pump Pulley

3. Remove pulley from shaft using J-21883, Pump Pulley Puller, Fig. 9-25.

CAUTION: Never remove pulley by pounding it off with a hammer. This could damage pulley as well as snap ring at inner end of the shaft. If the snap ring is damaged, complete disassembly of the pump is required for replacement.

4. Remove woodruff key from shaft.

5. Remove bracket from pump.

6. Place pump assembly in vise, shaft down, using flat on housing for one clamping surface. Do not exert excessive force, as this may distort bearing.

7. Remove pressure union and O-ring seal from rear of pump assembly. Discard O-ring seal.

CAUTION: Spring loaded flow control valve tends to "pop" out when pressure union is removed.

8. Lift reservoir from pump housing by rocking reservoir up and away from housing.

9. Remove and discard outer pump housing O-ring seal, mounting bolt O-ring seals, and flow control valve opening O-ring seal.

10. Remove magnet from pump housing.

11. Rotate end plate retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-26.

(NOTE: Hold hand over retaining ring as end plate is spring loaded and may pop-out.)

12. Remove end plate and end plate "O" ring. End plate is spring loaded and will generally raise above the housing, making removal easy. However, if end plate

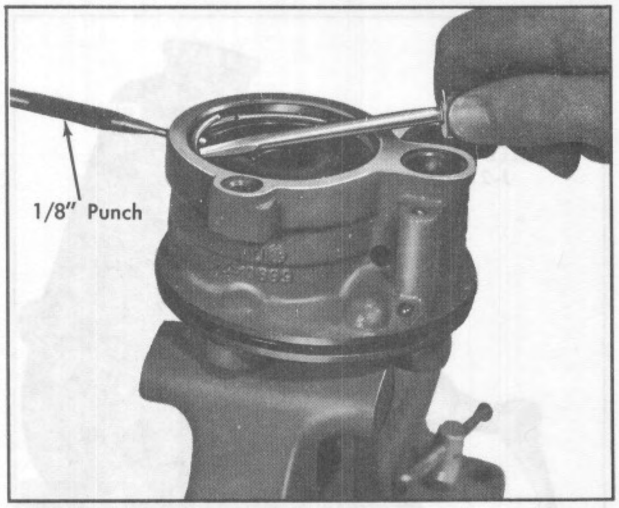


Fig. 9-26 Removing End Plate Retaining Ring

should stick, a slight rocking action on top surface will free the plate, Fig. 9-27.

13. Remove pressure plate spring.

14. Remove pump from vise and invert. Flow control valve and spring will fall free, Fig. 9-28. Flow control valve is serviced as a unit and should not be disassembled.

15. Tap very lightly on end of shaft, only until pressure plate falls free, Fig. 9-29.

16. Remove pressure plate, shaft with rotor and vanes, and thrust plate attached.

17. Remove vanes from rotor, then remove retaining ring from splined end of shaft and remove rotor and thrust plate from shaft. Discard retaining ring.

(NOTE: To remove retaining ring, clamp shaft in soft jawed vise, and using a pair of long nose pliers or a screwdriver, pry retaining ring off shaft. Be careful not to damage shaft with vise jaws.)

18. Remove pressure plate O-ring seal and end plate O-ring seal from bore of housing and discard.

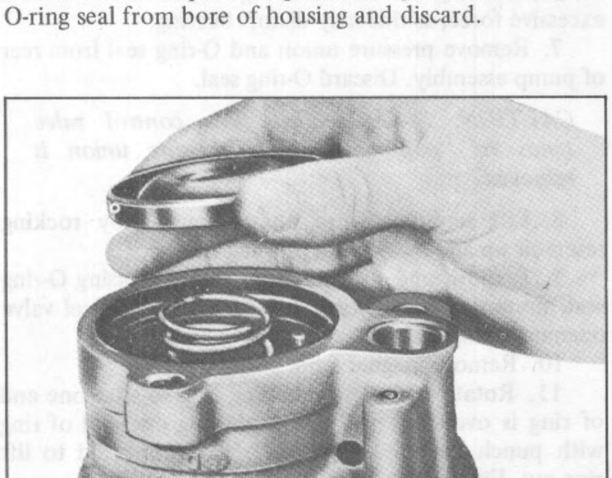


Fig. 9-27 Removal of End Plate Exposing Spring

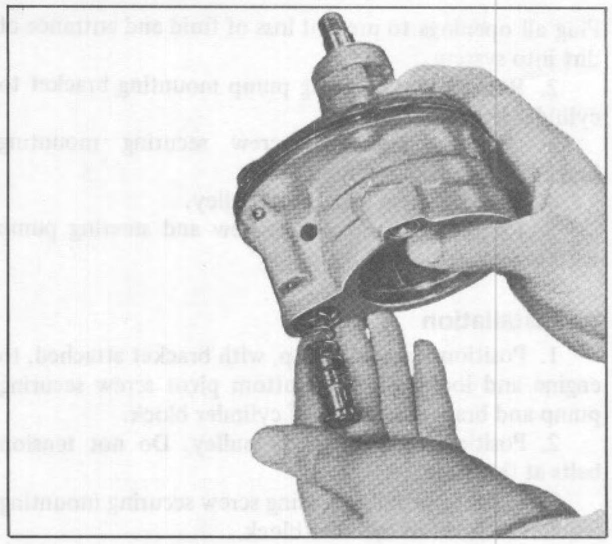


Fig. 9-28 Removal of Flow Control Valve and Spring

19. Remove shaft seal by prying out with screwdriver and discard seal.

(NOTE: Take care not to damage housing bore.)

b. Cleaning and Inspection

Carefully clean all pump parts in non-toxic cleaning solvent. Remove ferrous material adhering to magnut. Replace any damaged or worn parts.

1. Inspect flow control valve assembly for score marks, wear, burrs, or other damage.

2. Inspect castings for cracks or other visual evidence of damage. Check machined surfaces, especially mating surfaces on O-ring seats, for scratches or burrs that might permit leaks. Examine the V-shaped notches at edges of discharge ports on pressure plate. These notches must be clean and undamaged if pump noise is to be avoided, as they cushion the hydraulic shock when each vane passes the port.

3. Inspect cam ring end surfaces for score marks.

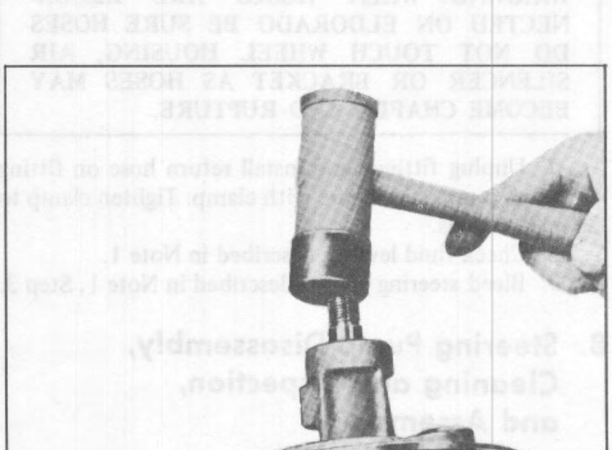


Fig. 9-29 Tapping Shaft to Unseat Pressure Plate

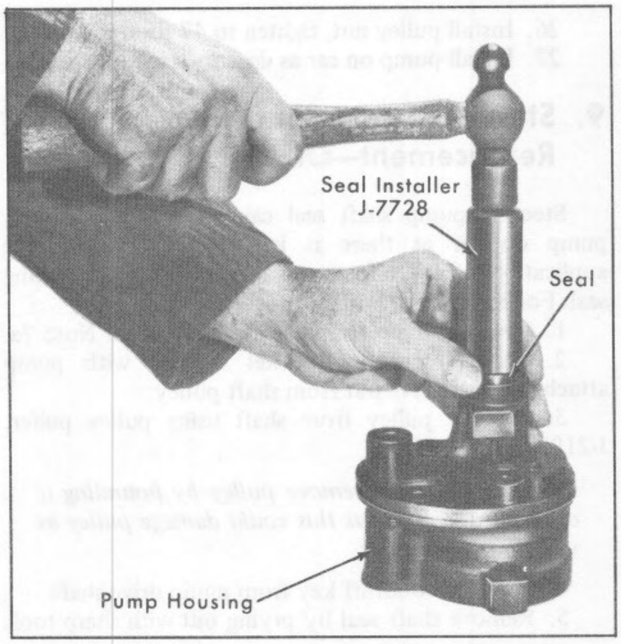


Fig. 9-30 Installing Pump Shaft Seal

(NOTE: Cam ring is specially treated which leaves a dull gray-black finish on wear surface. Wavy grain appearance inside cam ring is normal.)

4. Inspect pump shaft for score marks, excessive wear, or damage – particularly at splines, keyway, and at bearing and seal surfaces. Separate rotor and vanes and inspect for wear and general condition.

5. Inspect shaft bushing in pump housing, and replace pump housing if bushing is scored or excessively worn.

6. If any internal parts are found to be worn or damaged, disassemble gear and clean internal parts.

c. Assembly

1. Lubricate new O-ring seals and seat areas with power steering fluid.

2. Lubricate new shaft seal with power steering fluid and install in housing with metal backing up. Use Seal Installer, J-7728, Fig. 9-30.

3. Install new pressure plate and end plate O-ring seals in grooves in pump housing.

4. Install thrust plate on drive shaft with ported face toward splined end of shaft.

5. Install rotor on shaft with counterbored end toward thrust plate.

6. Clamp shaft in soft jawed vise and install new retaining ring on splined end of shaft by prying ring open and sliding it down over shaft until it seats itself in ring groove. Be careful not to damage shaft.

7. Insert drive shaft with thrust plate and rotor into housing, using Seal Protector, J-22616, Fig. 9-31. Make sure that shaft is properly seated.

8. Place pump housing in vise, hub down, using flat on hub for one clamping surface.

9. Install dowel pins through thrust plate into pump housing.

10. Install cam ring on dowel pins with rotation arrow toward rear of pump housing and pointing in direction of pump rotation, Fig. 9-32. Direction of rotation is counterclockwise when viewed from rear of pump.

Fig. 9-31 Installing Pump Shaft Assembly

11. Install vanes in slots in rotor, with radius edges toward outside of rotor, so they ride on cam ring.

12. Lubricate outside diameter of pressure plate with petrolatum or equivalent to prevent damage to O-ring and install pressure plate on dowel pins with ported face toward cam ring. Install plate so that narrow slots in plate engage dowel pins. Make sure that pressure plate is properly seated by tapping lightly around outer circumference with a wooden hammer handle.

13. Install pressure plate spring.

14. Lubricate outside diameter of end plate with petrolatum or equivalent and install end plate in pump housing.

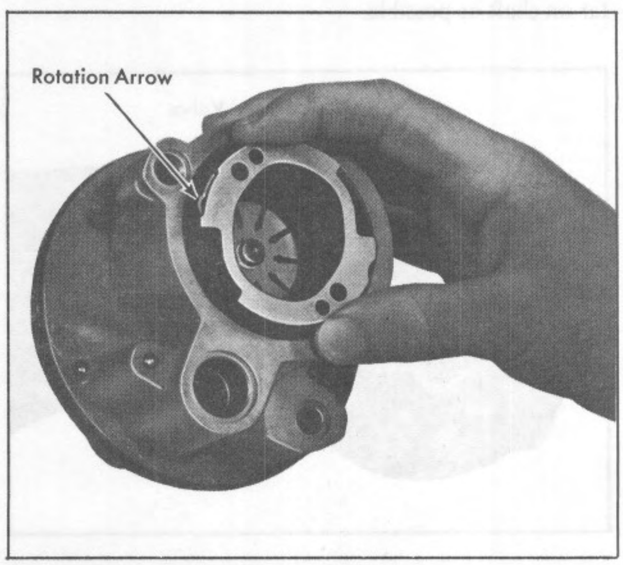


Fig. 9-32 Installing Cam Ring

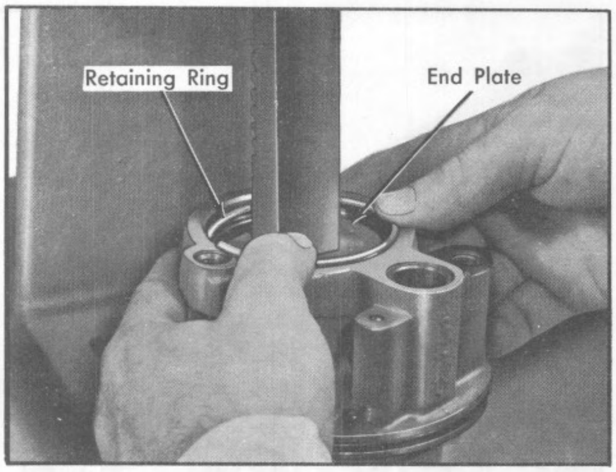


Fig. 9-33 Installing End Plate Retaining Ring

15. Place pump housing in arbor press, depress end plate below retaining ring groove, and install end plate retaining ring, Fig. 9-33. Make certain that ring is completely seated in groove of housing.

16. Place cleaned magnet flat against pump housing adjacent to pump inlet port.

17. Install new outer pump housing O-ring seal, flow control valve opening O-ring seal, and mounting bolt O-ring seals in pump housing.

18. Install reservoir on pump housing. Do not hammer on housing.

19. Install flow control valve spring.

20. Install flow control valve (hex head screw goes into bore first), Fig. 9-34.

21. Install pressure union using a new O-ring seal. Tighten to 32 foot-pounds.

22. Install mounting bracket on pump and secure with three screws. Tighten screws to 32 foot-pounds.

23. Clamp mounting bracket in vise with pump attached.

24. Install woodruff key in shaft.

25. Install pulley on shaft by first aligning key in shaft with keyway in pulley. Position pulley by hand as far on shaft as possible.

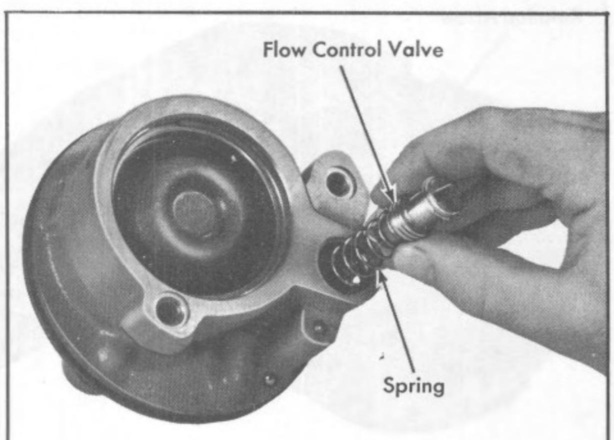


Fig. 9-34 Installing Flow Control Valve

26. Install pulley nut, tighten to 47 foot-pounds.

27. Install pump on car as described in Note 7b.

9. Steering Pump Shaft Seal Replacement—Off Car

Steering pump shaft seal cannot be replaced with pump on car as there is insufficient clearance for application of tools for removing pulley and installing seal. For replacing seal only, proceed as follows:

1. Remove pump from car as described in Note 7a.

2. Clamp mounting bracket in vise with pump attached and remove nut from shaft pulley.

3. Remove pulley from shaft using pulley puller, J-21883, Fig. 9-25.

CAUTION: Never remove pulley by pounding it off with a hammer as this could damage pulley as well as internal parts.

4. Remove woodruff key from pump drive shaft.

5. Remove shaft seal by prying out with sharp tool.

CAUTION: Insert sharp tool between seal and pump housing. Do not pry against pump shaft.

6. Remove pump and mounting bracket from vise and lay flat on bench, allowing return pipe to hang over side of bench, Fig. 9-35, so it will not be damaged when installing new shaft seal.

CAUTION: Pump mounting bracket may be damaged if clamped in vise while installing new shaft seal.

7. Install Seal Protector, J-22616, on pump drive shaft.

8. Position new shaft seal on drive shaft with metal backing facing pulley end of shaft.

9. Install seal, using Pump Shaft Seal Installer, J-7728, Fig. 9-30. Tap tool lightly with small hammer until seal is properly seated in shaft hub.

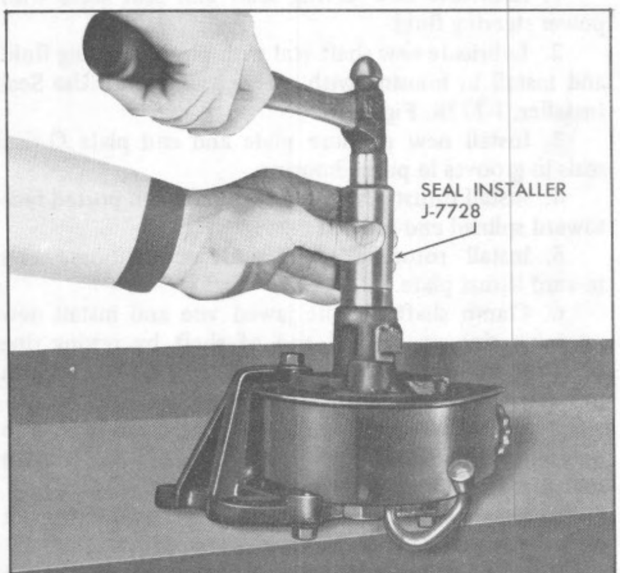


Fig. 9-35 Installing Pump Shaft Seal (Off Car)

10. Clamp mounting bracket in vise with pump attached.

11. Install woodruff key in shaft.

12. Install pulley on shaft by first aligning key in shaft with keyway in pulley. Position pulley by hand as far on shaft as possible.

13. Install pulley nut, tighten to 47 foot-pounds.

14. Install pump on car as described in Note 7b.

10. Steering Gear—Except Eldorado

a. Removal

1. Position container under gear to catch dripping fluid.

2. Disconnect pressure and return lines at steering gear. Plug all openings to prevent loss of fluid and entrance of dirt into system.

3. Remove two nuts and lockwashers that hold the upper half of the flexible coupling to the lower shaft.

4. Raise car.

5. Remove nut and lockwasher, break pitman arm loose from pitman shaft using Pitman Arm Puller, J-9172, and remove pitman arm from steering gear.

(NOTE: Residual torque on nut after driving may range from 10-200 foot-pounds.)

6. Remove three screws that hold steering gear to frame side rail, lower gear assembly down and out of car with pitman arm attached.

b. Installation

1. Position steering gear to frame side rail so that flexible coupling bolts engage upper flange.

(NOTE: One bolt is 5/16", the other is 3/8".)

Secure gear to side rail with three mounting screws. Tighten screws to 55 foot-pounds.

See CAUTION on page 9-28.

2. Position pitman arm on pitman shaft and install lockwasher and nut. Tighten nut to 185 foot-pounds to seat arm on shaft.

See CAUTION on page 9-28.

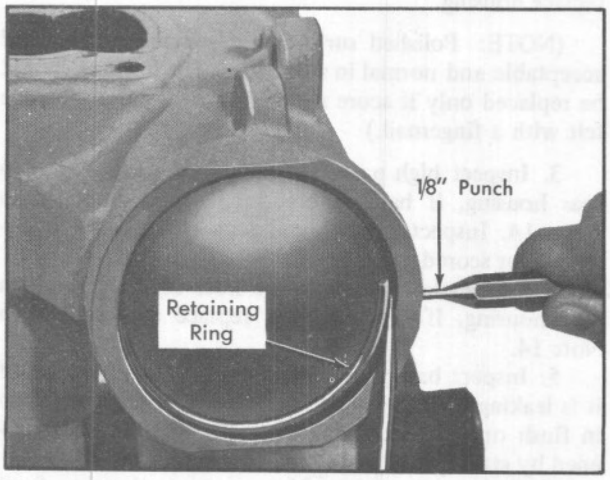


Fig. 9-36 Removing End Cover Retaining Ring

3. Lower car.

4. Unplug openings and connect pressure and return lines to steering gear. Tighten fittings to 30 foot-pounds.

5. Install 5/16" nut and lockwasher, and 3/8" nut and lockwasher to bolts through the flexible coupling. Tighten nuts to 20 foot-pounds.

See CAUTION on page 9-28.

6. Check fluid level and bleed steering system as outlined in Note 1.

11. Steering Gear, Removal of Major Components

1. Position gear assembly in vise with end cover tilted upward about 20°, and clamp lower tab at valve end of gear.

2. Remove locknut from adjuster screw on end of pitman shaft and discard.

3. Remove four side cover-to-housing retaining screws.

4. Rotate pitman shaft adjuster screw with an Allen wrench until side cover is lifted free from housing.

5. Separate side cover from pitman shaft. Discard side cover O-ring if necessary.

6. Rotate gear housing end cover retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-36.

7. Rotate coupling flange counterclockwise until rack-piston loosens end cover in housing. Remove end cover and O-ring from housing.

CAUTION: Do not rotate any further than necessary or balls with fall out of their circuit and pitman shaft teeth and rack-piston will become disengaged.

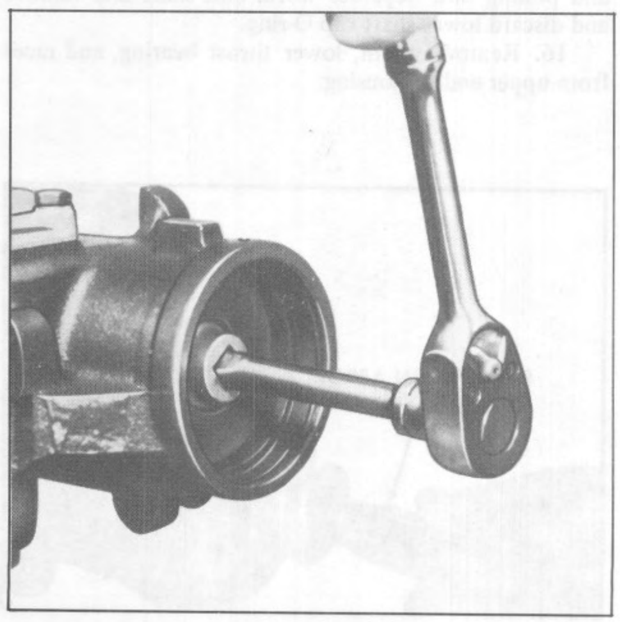


Fig. 9-37 Removing Rack Piston End Plug

8. Remove rack-piston end plug in the following manner.

a. Strike end plug with a plastic mallet to unseat threads.

(NOTE: This is important, as end plug is tightened to 80 foot-pounds during assembly and could break during removal if not handled carefully.)

b. Turn flexible coupling flange until pitman shaft teeth are centered in housing.

c. Use a ratchet and a 1/2 inch square drive extension to remove end plug, Fig. 9-37.

9. Tap end of pitman shaft with a soft mallet and slide pitman shaft out of housing. Remove slowly as oil will drain from the housing.

10. Remove housing end plug O-ring seal from housing and discard if not previously removed.

11. Insert Rack-Piston Arbor, J-21552, into rack-piston against end of worm. Turn coupling flange counterclockwise, while holding tool tightly against worm, to force rack-piston on to arbor. Hold tool and pull rack-piston farther onto tool to prevent end circuit balls from falling out, and remove rack-piston from gear housing, Fig. 9-38. Do not remove Rack-Piston Arbor from rack-piston until ready to remove balls from rack-piston.

(NOTE: On Eldorado steering gears the large snap ring visible at the bottom of the bore is a stop. Do not remove this snap ring.)

12. Remove flexible coupling flange retaining screw and remove coupling flange assembly.

13. Remove adjuster plug locknut by breaking it loose with hammer and punch, and remove locknut from housing.

14. Loosen adjuster plug assembly, using Spanner Wrench J-7624, Fig. 9-39, and remove from housing. Remove and discard adjuster plug O-ring.

15. Remove valve assembly by grasping stub shaft and pulling out. Separate worm and shaft and remove and discard lower shaft cap O-ring.

16. Remove worm, lower thrust bearing, and races from upper end of housing.

Fig. 9-38 Installing Rack Piston Arbor

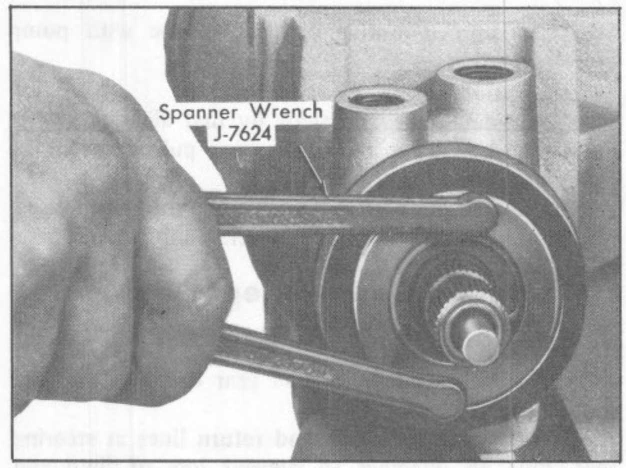


Fig. 9-39 Removing Adjuster Plug

12. Steering Gear, Disassembly, Inspection, and Assembly of Major Components

Disassembly of the major components within the gear must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Refer to Fig. 9-40 for parts nomenclature and location.

a. Gear Housing, Pitman Shaft Needle Bearing, and Seals

Disassembly

1. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and, then remove outer back-up washer.

2. Drive needle bearing, outer seal, inner backup washer, and inner seal from gear housing bore with Pitman Shaft Bearing Remover, J-6657. Discard seals.

Inspection

1. Inspect pitman shaft and needle bearing for broken or pitted rollers.

2. Inspect housing bore. If badly scored or worn, replace housing.

(NOTE: Polished surfaces are generally considered acceptable and normal in such cases. The housing should be replaced only if score marks or a wear pattern can be felt with a fingernail.)

3. Inspect high pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14. Inspect poppet and seat and replace if deformed or scored.

4. Inspect low pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14.

5. Inspect ball plug in valve body end of housing. If it is leaking or raised above the surface, it may be driven in flush or 1/16 inch below surface. Ball can be tightened by staking housing.

6. Inspect all retaining ring grooves and seal surfaces for damage or failure.

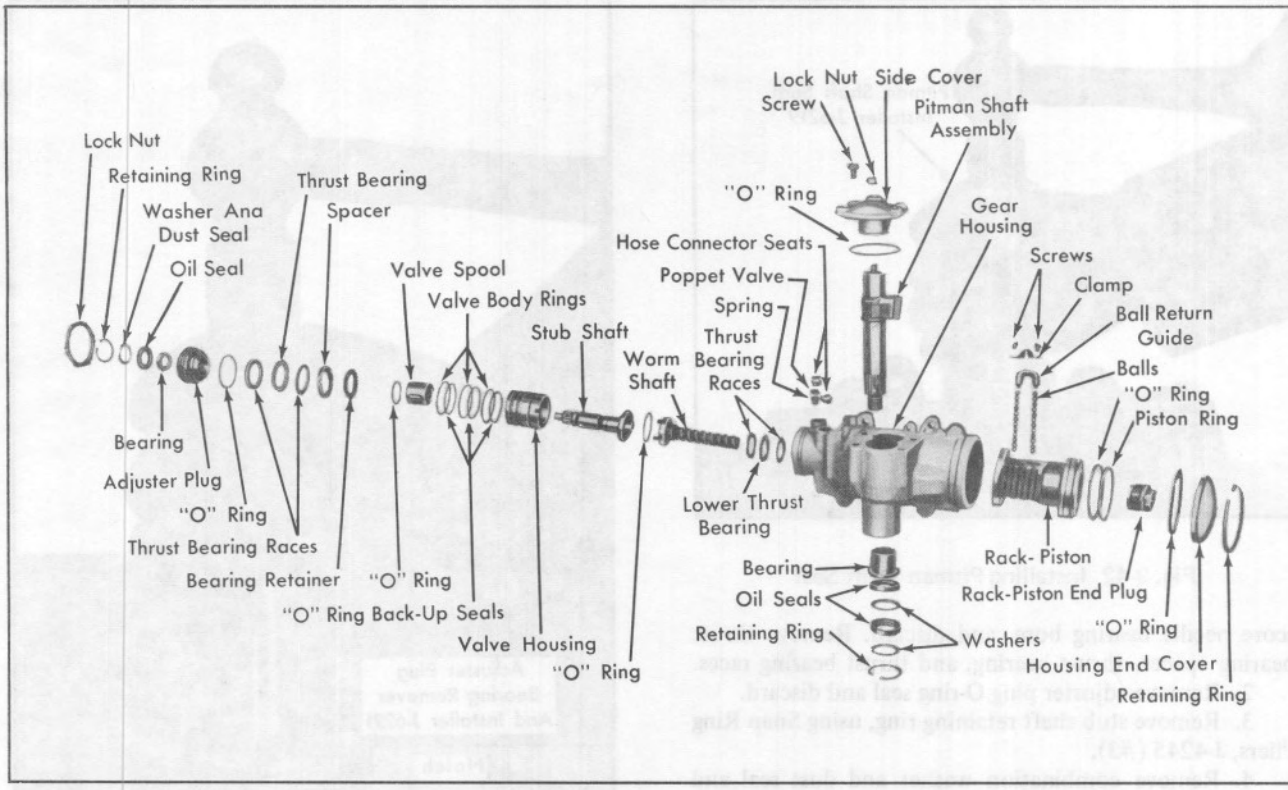


Fig. 9-40 Steering Gear Disassembled

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Install pitman shaft needle bearing on Bearing Installer J-22407, with shoulder on bearing against tool. Position bearing and tool in housing and press bearing into housing, until bearing is bottomed out against hub of housing, Fig. 9-41. On constant ratio steering gears press bearing in until bottom edge of bearing is flush with the housing bore surfaces.

3. Lubricate pitman shaft bore and single lip pitman shaft seal with power steering fluid and install seal, lip down, into bore, using Seal Installer, J-6219, Fig. 9-42. Do not drive seal more than 1/8 inch below lip of bore.

4. Remove tool and place steel washer on top of seal. Using tool J-6219, drive seal approximately 1/2 inch further into bore.

5. Lubricate double lip seal with power steering fluid and install seal into housing bore. Using Seal Installer, J-6219, drive seal down into bore until top edge of seal is flush with bottom edge of retaining ring groove.

6. Remove tool and place steel washer and retaining ring over seal. Using tool J-6219, drive both seals down into bore until retaining ring falls into retaining ring groove.

(NOTE: In order to avoid possible damage to sealing surface of lower seal, it is important that seals and washers be driven down only far enough so that retaining ring falls into ring groove.)

b. Adjuster Plug Assembly

(NOTE: If replacing oil seal <u>only</u>, install adjuster plug loosely in the gear housing. Remove retaining ring with Snap Ring Pliers, J-4245. Pry out dust seal and oil seal from bore of adjuster plug, being careful not to score the needle bearing bore. To install, follow Steps 2, 3, and 4 under Assembly.)

Disassembly

1. Remove thrust bearing retainer with a screwdriver, Fig. 9-43. Pry alternately on dimples so as not to

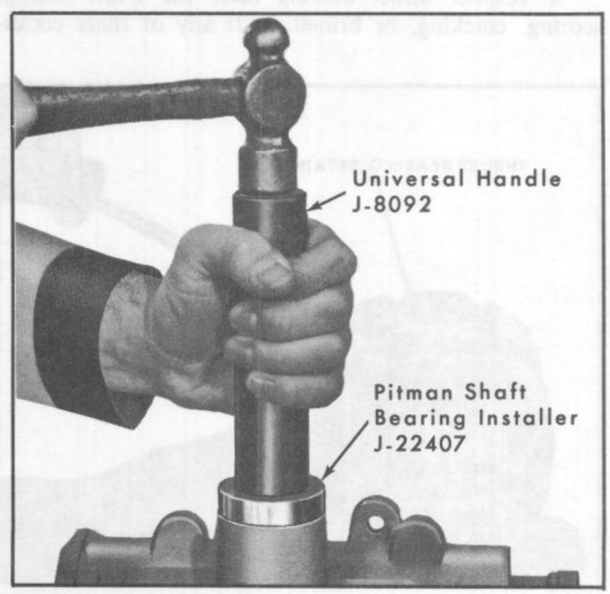


Fig. 9-41 Installing Pitman Shaft Bearing

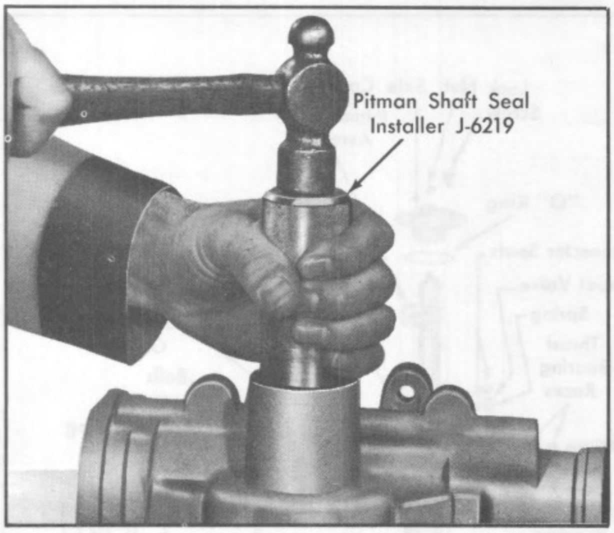


Fig. 9-42 Installing Pitman Shaft Seal

score needle bearing bore, and discard. Remove thrust bearing spacer, thrust bearing, and thrust bearing races.

2. Remove adjuster plug O-ring seal and discard.

3. Remove stub shaft retaining ring, using Snap Ring Pliers, J-4245 (#3).

4. Remove combination washer and dust seal and discard.

5. Remove stub shaft oil seal by prying out with screwdriver and discard.

Inspection

1. Inspect needle bearing in adjuster plug. If rollers are broken or pitted, remove needle bearing by pressing out from thrust bearing end, using Adjuster Plug Bearing Remover and Installer, J-6221, Fig. 9-44.

2. Inspect thrust bearing spacer for cracks.

3. Inspect thrust bearing rollers for wear, pitting, scoring, or cracking. If any of these conditions are found, replace bearing and both thrust bearing races.

4. Inspect thrust bearing races for wear, pitting, scoring, cracking, or brinelling. If any of these conditions are found, replace races and check thrust bearing and thrust bearing spacer.

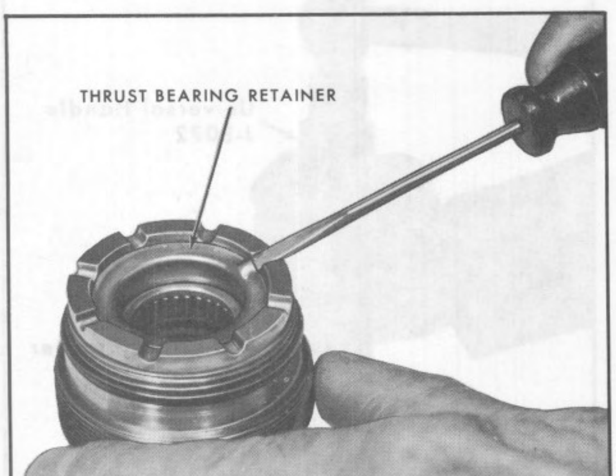


Fig. 9-43 Removing Thrust Bearing Retainer

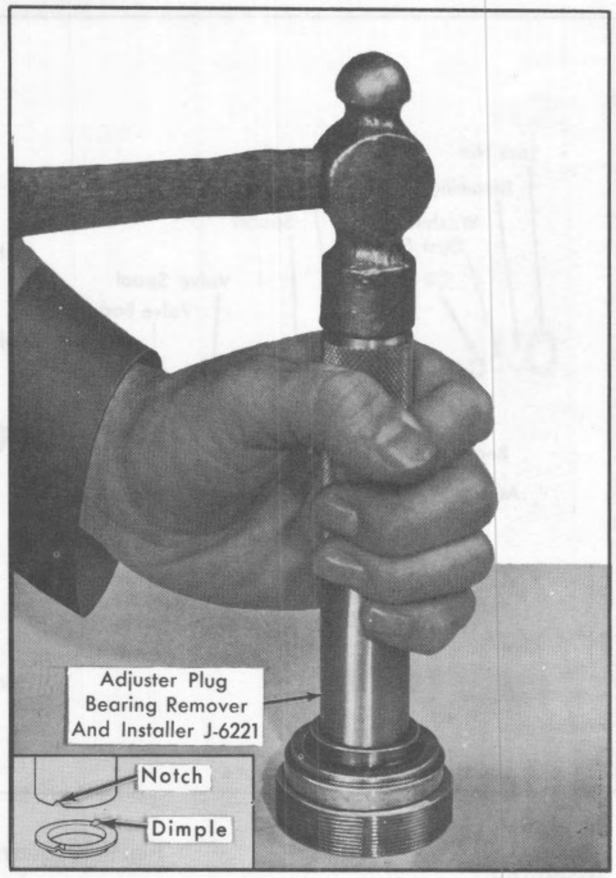


Fig. 9-44 Removing and Installing Adjuster Plug Bearing

Assembly

1. If adjuster plug needle bearing was previously removed, install new needle bearing on Tool J-6221, with letters on bearings against tool. Position bearing and tool over thrust bearing end of plug and drive bearing into plug, Fig. 9-44. End of bearing must be flush with bottom surface of stub shaft seal bore.

2. Lubricate new stub shaft oil seal with power steering fluid and, using Adjuster Plug Seal Installer, J-5188, Fig. 9-45, install seal far enough to provide clearance for dust seal and retaining ring.

3. Lubricate new dust seal with power steering fluid and install in plug with rubber face outward.

4. Install retaining ring with Snap Ring Pliers, J-4245 (#3), making certain that ring is properly seated.

5. Lubricate new O-ring seal with power steering fluid and install in groove on adjuster plug. Assemble flanged thrust bearing race, and thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Press bearing retainer into needle bearing bore, using a brass or wooden dowel. Radial location of dimples is not important.

(NOTE: Dowel used to install thrust bearing retainer should be notched to clear retainer dimples. Dimples will distort if used as installation surface.)

Fig. 9-45 Installing Oil Seal

c. Stub Shaft and Valve Assembly

The complete valve assembly is a precision unit with selective fitted parts hydraulically balanced during assembly. If replacement of any valve part other than rings or seals is necessary, the complete rotary valve assembly must be replaced.

Do not disassemble valve unless absolutely necessary, to avoid possibility of damage to the assembly. If valve spool dampener O-ring requires replacement, remove valve spool as outlined below, replace O-ring and install spool.

Disassembly

1. Remove cap to worm O-ring seal and discard.

2. Remove stub shaft, torsion bar, and valve cap assembly by holding valve assembly in both hands, with thumbs on valve body. Tap torsion bar lightly against workbench. This will dislodge cap from valve body-to-cap pin. Move the assembly forward far enough for the cap to clear the valve body and disconnect the stub shaft pin from the valve spool. Then remove the stub shaft assembly leaving the spool in the valve body.

CAUTION: Clearance between valve body and spool is .0004-.0006 inch. Slightest cocking of spool may cause it to stick in the valve body.

3. Remove valve spool from valve body by withdrawing spool from the flat end of the valve body with a steady twisting pull to prevent jamming. If slight sticking occurs, carefully work spool back into valve body. If this does not free spool, it has become cocked in the valve body bore. Do not attempt to force the spool in or out if it becomes cocked. Visual inspection on a flat surface will show in which direction spool is cocked. A few very light taps with a light, soft plastic or rawhide mallet should align spool in bore and free it.

CAUTION: Do not tap with anything metallic. If spool can be rotated, it can be removed.

Inspection

1. If there is evidence that torsion bar O-ring seal inside stub shaft has been leaking, entire valve assembly should be replaced.

2. Check pin in valve body that engages cap. If it is severely worn, cracked, or broken, the entire valve assembly should be replaced.

3. Check smaller of the two worm pin grooves in valve body. If it is severely worn, entire valve assembly should be replaced.

4. Check spool drive pin on stub shaft. If it is severely worn, cracked, or broken, entire valve assembly should be replaced.

5. Examine spool O.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

6. Examine valve body I.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

7. Check fit of spool in valve body before installing valve spool dampener O-ring seal.

When lubricated with power steering fluid, spool should rotate smoothly without binding or catching. If either occurs, entire valve assembly should be replaced.

8. Examine needle bearing diameter of stub shaft. If it is badly worn, or scored, entire valve assembly should be replaced.

9. Visually inspect valve body rings. If damaged, carefully cut valve rings and O-ring back-up seals. Remove and discard.

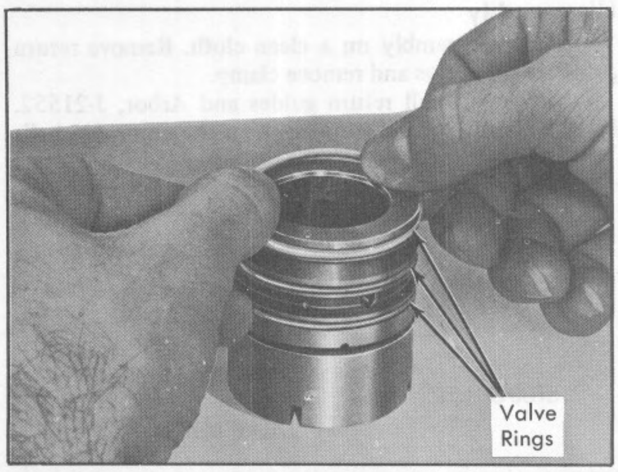


Fig. 9-46 Installing Valve Rings

Assembly

1. If new valve body back-up O-ring seals are necessary, lubricate them with power steering fluid. Assemble in ring grooves on valve body. Do not allow seals to become twisted. If new valve rings are necessary, lubricate them with power steering fluid and assemble valve rings in ring grooves over back-up O-ring seals by carefully slipping rings over valve body, Fig. 9-46. Rings may appear to be loose in grooves, but the heat of the oil after assembly will cause them to tighten.

2. Lubricate new valve spool dampener O-ring seal with power steering fluid and install seal in valve spool groove.

3. Install spool into valve body, Fig. 9-47, sliding it partially through toward notched end.

CAUTION: Because clearance between spool and valve body is .0004-.0006 inch extreme care must be taken when assembling these parts.

4. Insert stub shaft through spool to engage locking pin in spool.

5. Pull spool and stub shaft into valve body aligning stub shaft notch with valve body pin, Fig. 9-48.

6. Lubricate new cap-to-worm O-ring seal with power steering fluid and install in valve body.

(NOTE: Do not install upper thrust bearing assembly on valve assembly at this time.)

d. Pitman Gear Shaft and Side Cover

Inspection

1. Inspect pitman shaft bearing surface in side cover for excessive wear or scoring. If badly worn or scored, replace side cover.

(NOTE: The bearing may extend from the side cover. It is not necessary to reposition the bearing or replace the side cover if this condition occurs.)

2. Visually inspect pitman shaft sector teeth, bearing and seal surface. If abnormally worn, pitted, or scored, replace pitman shaft.

e. Rack-Piston and Worm Assembly

Disassembly

1. Place assembly on a clean cloth. Remove return guide clamp screws and remove clamp.

2. Remove ball return guides and Arbor, J-21552. Make sure all 24 balls are caught on the cloth, (22 balls

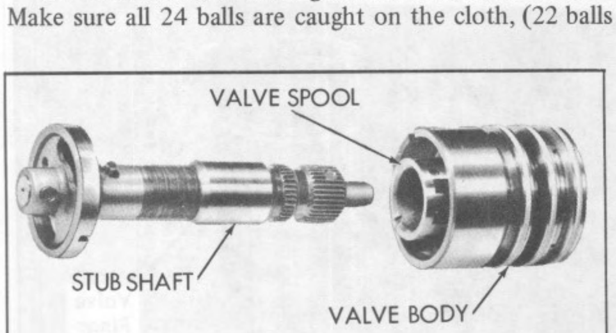


Fig. 9-47 Installing Spool in Body

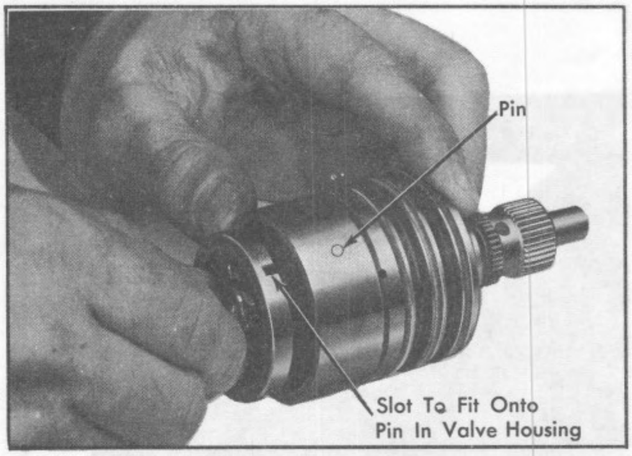


Fig. 9-48 Installing Stub Shaft

on constant ratio steering gear used in Limousines, and Commercial Vehicles).

(NOTE: Rack-piston ring seldom needs to be replaced.)

Inspection

1. Inspect worm and rack-piston grooves and all of the balls for excessive wear or scoring. If either worm or rack-piston needs replacing, both must be replaced as a matched assembly.

2. Inspect ball return guides, making sure that the ends where balls enter and leave the guides are not damaged.

3. Inspect lower thrust bearing and races for wear, pitting, scoring, or cracking. If any of these conditions are found, replace thrust bearing and races, and check worm.

4. Inspect rack-piston and end plug to be sure threads are not damaged.

5. Inspect rack-piston teeth for abnormal wear or scoring. Inspect rack-piston O.D. for abnormal wear, scoring, or burrs. If any of these conditions exist and are excessive, both the rack-piston and worm must be replaced.

6. Visually inspect piston ring; if damaged, remove ring and back-up O-ring seal and discard.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Lubricate new back-up O-ring seal, if necessary, with power steering fluid and install in piston ring groove on rack-piston. Do not allow seal to become twisted.

3. Install new piston ring, if necessary, in groove over O-ring seal.

4. Insert worm into end of rack-piston, from end opposite piston ring, until worm is against rack-piston shoulder.

5. Load 17 balls into guide hole nearest piston ring while slowly rotating worm counterclockwise to feed balls through circuit. Alternate black balls with white balls throughout the circuit.

(NOTE: Balls should be measured with a micrometer if mixed or color identification is questioned.

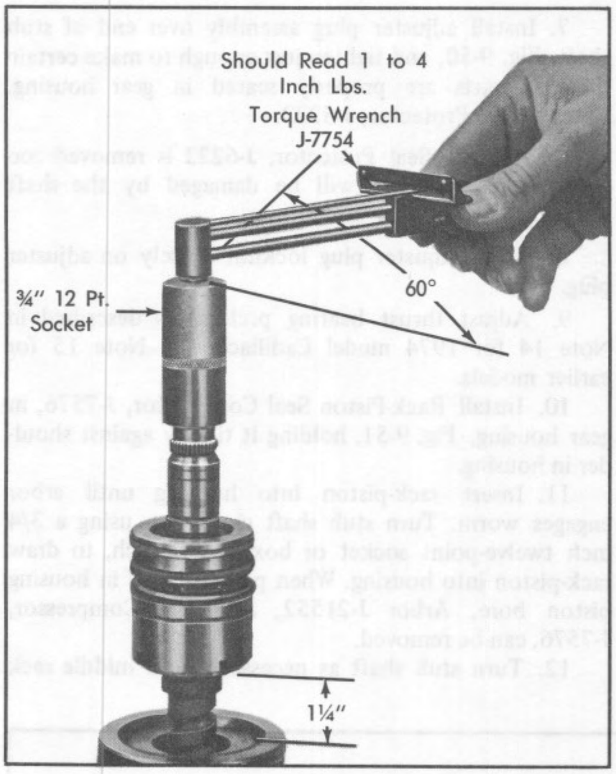


Fig. 9-49 Check Worm and Rack Piston Preload

The measured difference between the black and white balls is .0005 inch.)

6. Apply a liberal amount of petrolatum or equivalent to one ball return guide and install the remaining balls into guide, 7 balls on variable ratio gear and 5 balls on constant ratio gear. Place the other guide over the balls and ball guide, and insert guides into guide holes of rack-piston. Make sure black ball in guide is installed next to white ball in rack-piston or vice versa. Guides should fit loosely. It is essential that all balls be positioned so that they are alternate in color. No two balls of the same color are to be side by side.

7. Place return guide clamp over guides and secure with two screws and lockwashers. Tighten screws to 10 foot-pounds.

8. Worm groove is ground with a high point in the center. When rack-piston passes over this high point, a preload of 1 to 4 inch-pounds should be obtained. To measure preload of worm and rack-piston ball assembly, proceed as follows:

a. Clamp rack-piston in a bench vise with soft jaws with worm shaft pointing up. Do not distort rack-piston by over-tightening vise.

b. Place valve assembly on worm engaging worm drive pin.

c. Rotate worm until it extends 1-1/4 inches from rack-piston to thrust bearing face. This is center position.

d. Place Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft, Fig. 9-49, and rotate wrench through an arc of approximately 60° in both directions several times, then take a torque reading. Highest average reading obtained with worm rotating should be between 1 and 4 inch-pounds.

9. If reading is below 1 inch-pound, a new set of balls must be installed upon reassembly. Final preload on replacement balls should be 2 or 3 inch-pounds.

10. Remove valve assembly from worm.

11. Remove rack-piston from vise.

12. insert Worm Gear Ball Arbor, J-21552, into worm and turn rack-piston onto arbor. Do not allow arbor to separate from worm until rack-piston is fully on arbor.

13. Steering Gear, Installation of Major Components

1. Position gear housing horizontally in vise and clamp lower tab at valve end of gear as shown in Fig. 9-66.

2. Lubricate worm shaft, lower thrust bearing, and races with power steering fluid, then position thrust bearing and races on worm.

(NOTE: Races must be positioned in same direction with cupped side towards worm shaft and curved side towards gear housing.)

3. Align valve body drive pin on worm with narrow pin slot on valve body. Be sure O-ring seal between valve body and worm head is installed.

4. Position valve assembly and worm shaft in housing as an integral unit.

CAUTION: Do not push against stub shaft, as this might cause stub shaft and cap to pull out of valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly can be installed by pushing on the outer diameter of the valve body housing with the fingers of both hands. Make certain that white plastic rings are not binding on inside of housing. Valve assembly is properly seated when oil return hole in gear housing is fully visible.

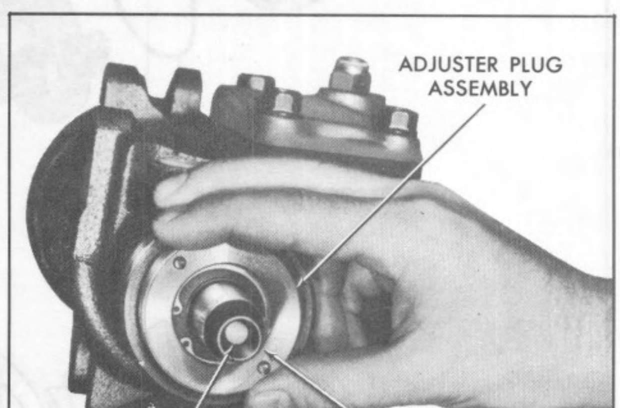


Fig. 9-50 Installing Adjuster Plug

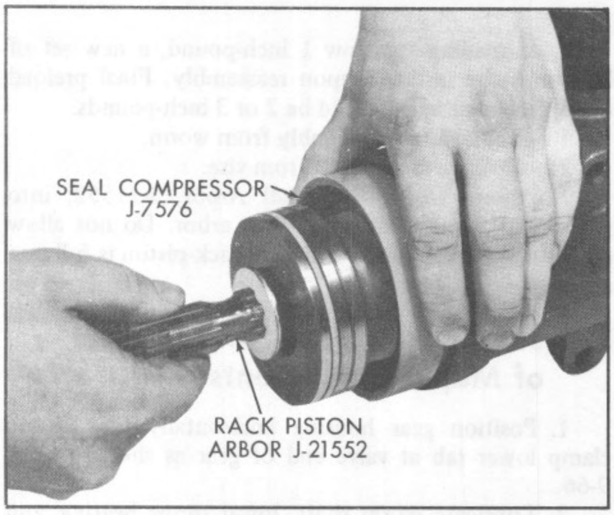


Fig. 9-51 Installing Rack Piston

5. Place Adjuster Plug Seal Protector, J-6222, over end of stub shaft.

6. Lubricate new adjuster plug O-ring seal with power steering fluid and install in groove on adjuster plug.

7. Install adjuster plug assembly over end of stub shaft, Fig. 9-50, and tighten just enough to make certain that all parts are properly seated in gear housing. Remove Seal Protector, J-6222.

(NOTE: If Seal Protector, J-6222 is removed too soon, stub shaft seal will be damaged by the shaft splines.)

8. Install adjuster plug locknut loosely on adjuster plug.

9. Adjust thrust bearing preload as described in Note 14 for 1974 model Cadillac's and Note 15 for earlier models.

10. Install Rack-Piston Seal Compressor, J-7576, in gear housing, Fig. 9-51, holding it tightly against shoulder in housing.

11. Insert rack-piston into housing until arbor engages worm. Turn stub shaft clockwise, using a 3/4 inch twelve-point socket or box end wrench, to draw rack-piston into housing. When piston-ring is in housing piston bore, Arbor J-21552, and Seal Compressor, J-7576, can be removed.

12. Turn stub shaft as necessary until middle rack

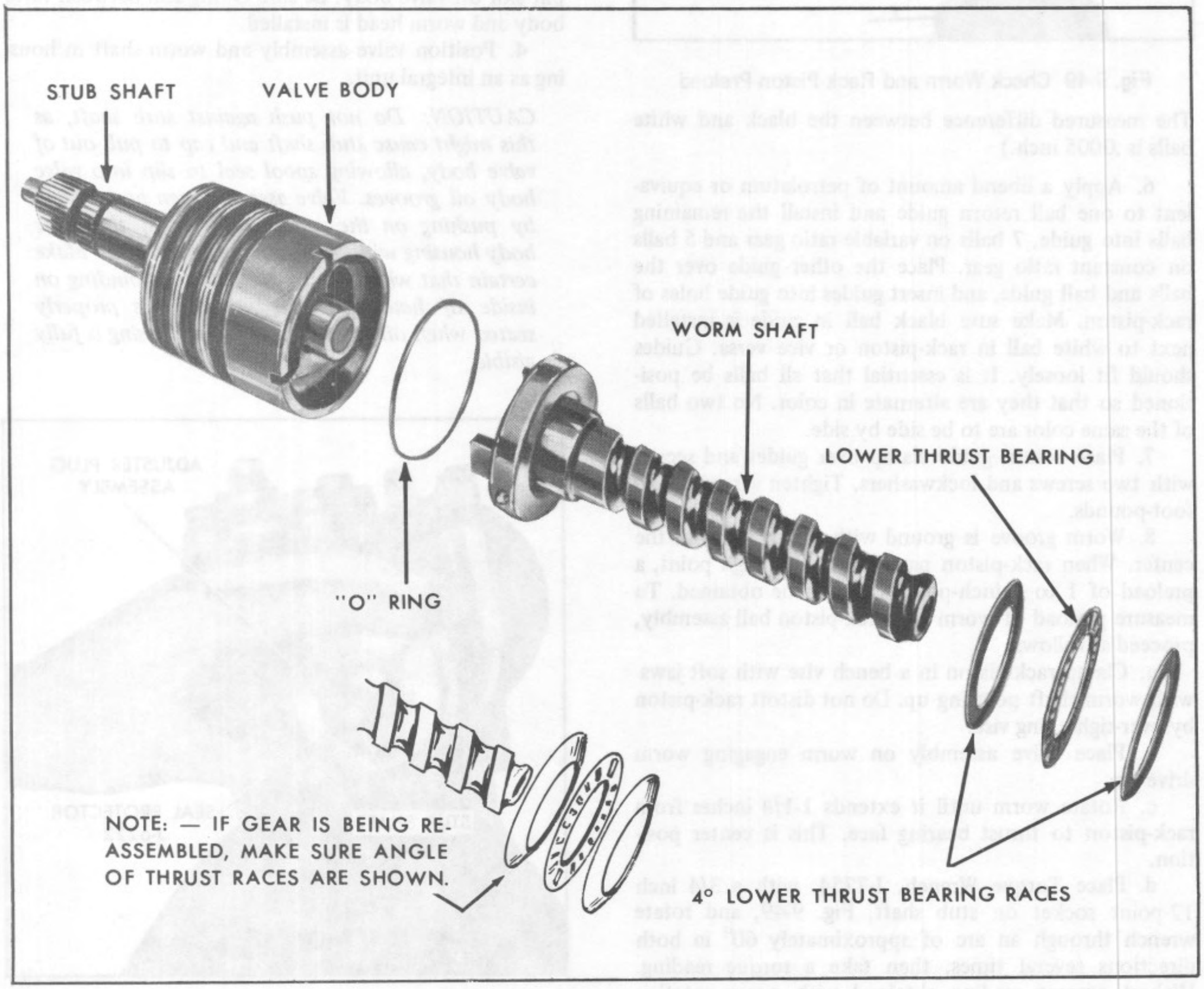


Fig. 9-52 Lower Thrust Bearing Assembly

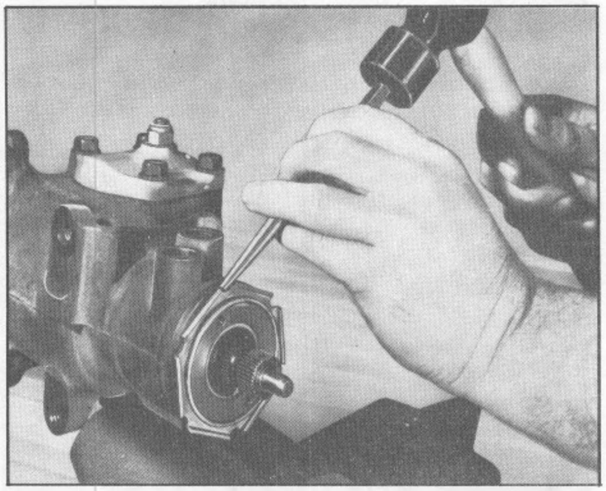


Fig. 9-53 Loosening Adjuster Plug Lock Nut

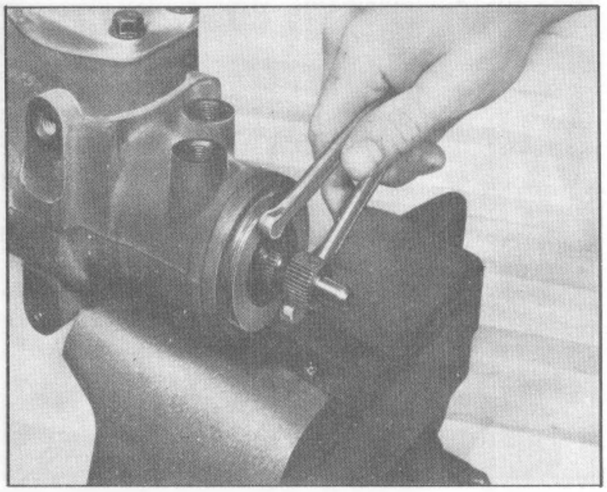


Fig. 9-55 Turning Adjuster Plug

groove in rack-piston is aligned with center of pitman shaft needle bearing.

13. Lubricate new side cover O-ring and install in face of side cover.

14. Assemble side cover on pitman shaft by screwing cover onto pitman shaft adjuster screw until side cover bottoms on pitman shaft, and back off 1/2 turn.

15. Install pitman shaft so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before pushing side cover down on gear housing.

16. Install side cover screws and tighten to 30 foot-pounds.

17. Hold adjuster screw with Allen wrench and install new adjuster lock nut half way on adjuster screw.

18. Install rack-piston end plug in rack-piston. Tighten end plug to 80 foot-pounds.

19. Lubricate new housing end cover O-ring seal with power steering fluid and install in gear housing.

20. Insert end cover into gear housing and seat against O-ring seal. Slight tapping with a mallet may be necessary to seat end plug properly.

21. Snap end cover retainer ring into place with fingers. Slight tapping may be required to bottom retainer ring in the gear housing securely.

22. Adjust pitman shaft end play as described in Note 16.

23. Install flexible coupling flange assembly on stub shaft with .040 inch clearance between the adjuster plug and the coupling. Install flange screw in coupling. Tighten screw to 30 foot-pounds.

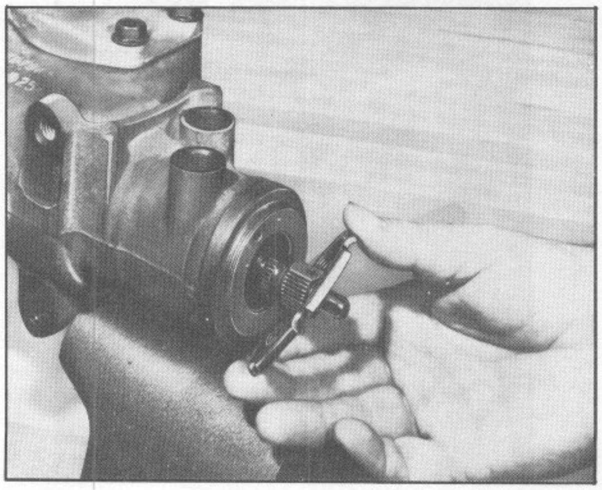


Fig. 9-54 Removing Adjuster Plug Lock Nut

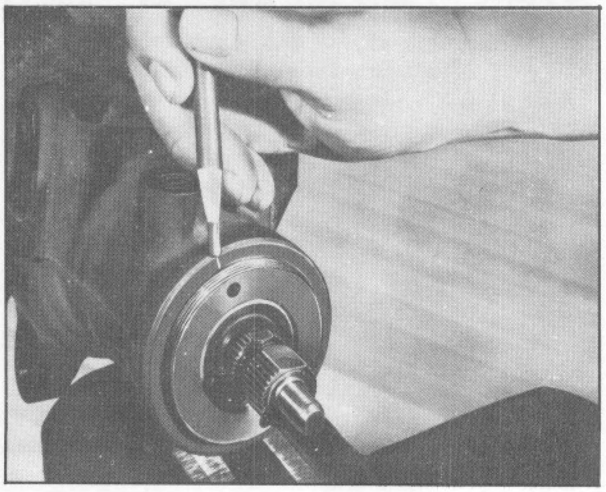


Fig. 9-56 Marking Housing

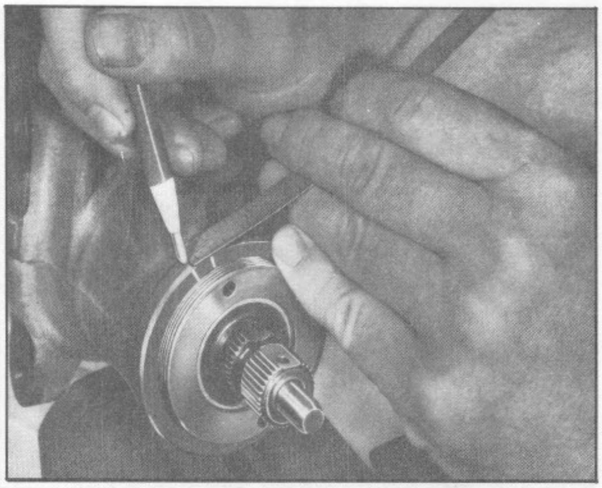


Fig. 9-57 Making Measurement

(NOTE: At the start of the 1974 model year, all power steering gear assemblies incorporate a new input shaft lower thrust bearing configuration. The thrust bearing itself remains unchanged, but both bearing races are conical, and essentially become axial spring washers to prevent loss of thrust bearing preload for the life of the car, Fig. 9-52.)

14. Thrust Bearing Adjustment

If a gear is known to contain the new thrust bearing parts, thrust bearing adjustment in service is simplified. Recommended procedure:

1. Drain power steering fluid from gear by rotating the stub shaft full travel in both directions several times.
2. Loosen and remove adjuster plug lock nut, Fig. 9-53 and 9-54.
3. Turn the adjuster plug in (clockwise) until the plug and thrust bearing are firmly bottomed - approximately 20 ft. lb. Fig. 9-55.
4. Mark the housing even with one of the holes in the adjuster plug (Fig. 9-56.

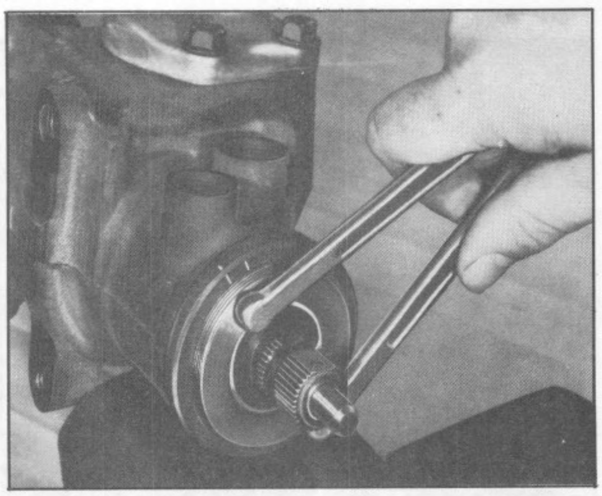


Fig. 9-58 Rotating Adjuster

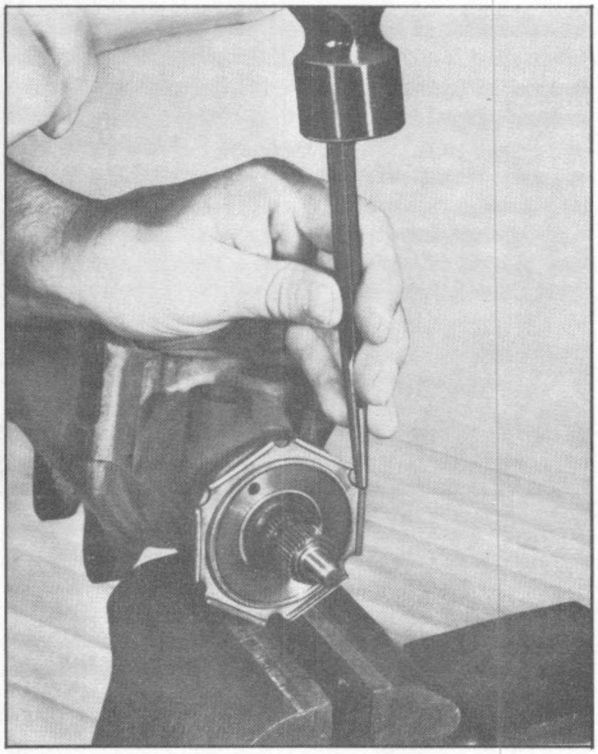


Fig. 9-59 Tightening Lock Nut

5. Measure back (counterclockwise direction) 3/16 to 1/4 inch and remark housing, Fig. 9-57.
6. Rotate adjuster (counterclockwise) until hole in adjuster is in line with second mark, Fig. 9-58.
7. Tighten lock nut securely. Hold (or have held) adjuster plug to maintain alignment of hole with mark, Fig. 9-59.
8. Turn the stub shaft to the right stop and then back 1/4 turn. Using an in.-lb. torque wrench, measure the torque. Reading should be taken with beam of torque wrench near vertical while turning

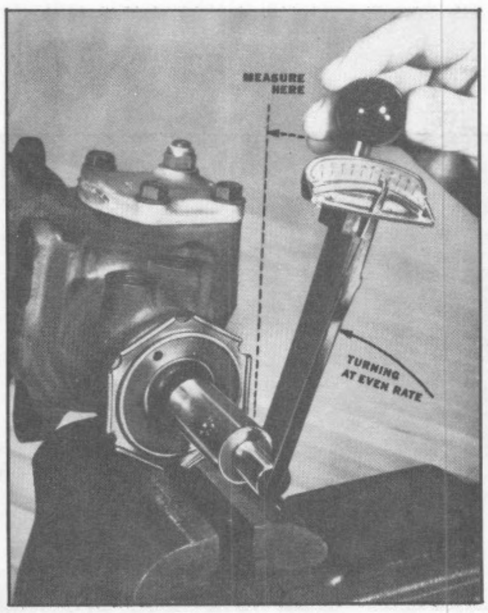


Fig. 9-60 Measuring Torque

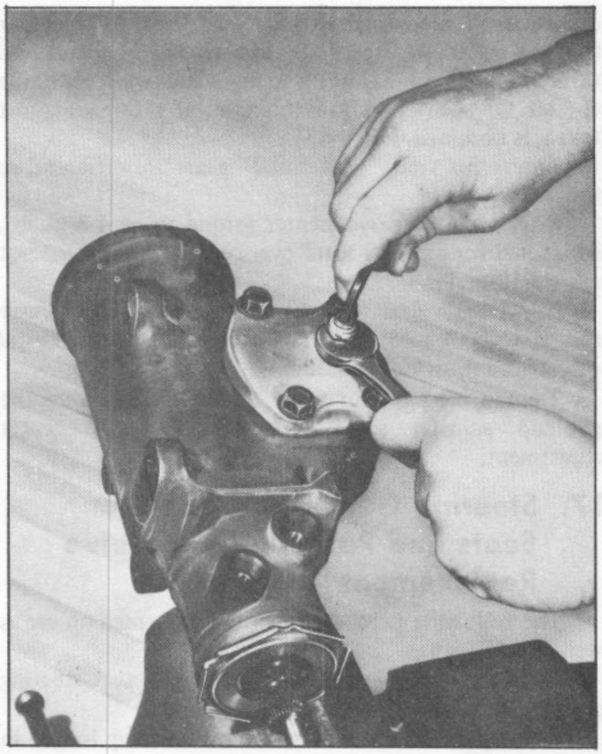


Fig. 9-61 Loosening Pitman Shaft Lock Nut

counterclockwise at an even rate. Fig. 9-60. If reading is less than 4, or more than 10 in lbs., use alternate adjustment procedure in Note 15.

15. Alternate Thrust Bearing Adjustment Procedure

(NOTE: Since past model steering gears, service kits, and service gears contain the flat, non-springy, thrust bearing races, the first adjustment procedure listed cannot be used. If there is any doubt about the type of races, use this procedure to adjust the thrust bearing preload.)

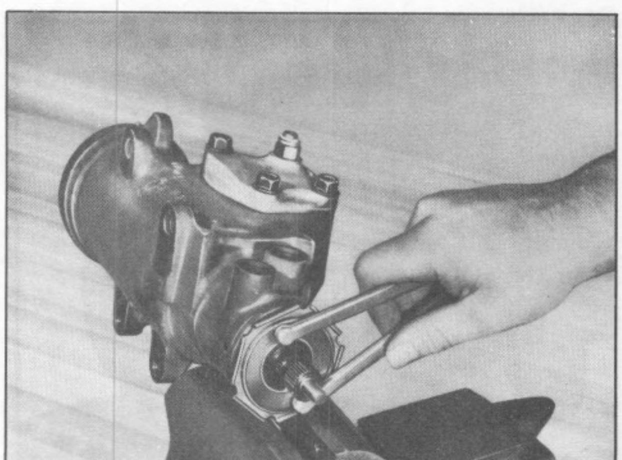


Fig. 9-62 Loosening Adjuster Plug

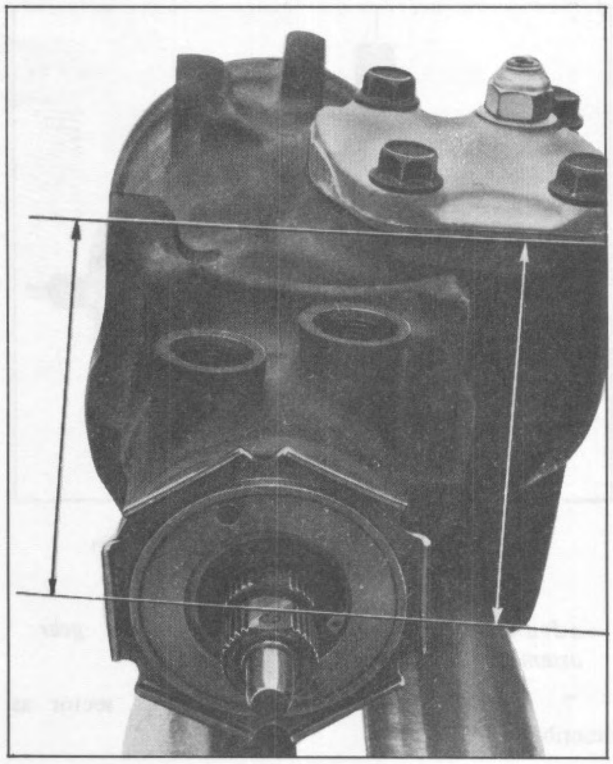


Fig. 9-63 Aligning Stub Shaft With Side Cover

1. Drain gear by rotating stub shaft from stop to stop several times.
2. Loosen pitman shaft preload adjuster screw lock nut and turn the preload adjuster screw 1-1/2 turns counterclockwise. Retighten the lock nut, Fig. 9-61. If when turning the preload screw counterclockwise, it bottoms, turn back clockwise one-half turn.
3. Loosen but, do not remove the adjuster plug lock nut, Fig. 9-53.
4. Loosen the adjuster plug one turn counterclockwise, Fig. 9-62.
5. Turn the stub shaft to the right stop and then back a quarter turn. Measure the drag torque using an in. lb. torque wrench, Fig. 9-60. Bottom the adjuster plug firmly (approximately 20 ft. lbs. by turning it clockwise, Fig. 9-62. Then back it off until the total torque reading is 3-4 in. lbs. in excess of the drag torque. (Ex: drag torque reading - 3 in. lbs. Total torque reading with adjuster plug tightened - 6-7 in. lbs.)
6. Tighten the adjuster plug lock nut securely, Fig. 9-59.

(NOTE: Preload torque tends to drop off when the lock nut is tightened. Therefore, the torque reading must be rechecked with the lock nut tight, and the torque must still be 3-4 in. lbs. in excess of the seal drag.)

CAUTION: It is not possible to properly adjust the thrust bearing preload unless the adjuster plug is firmly bottomed out and the torque set while the adjuster plug is being loosened. Never attempt to adjust the thrust preload while tightening or

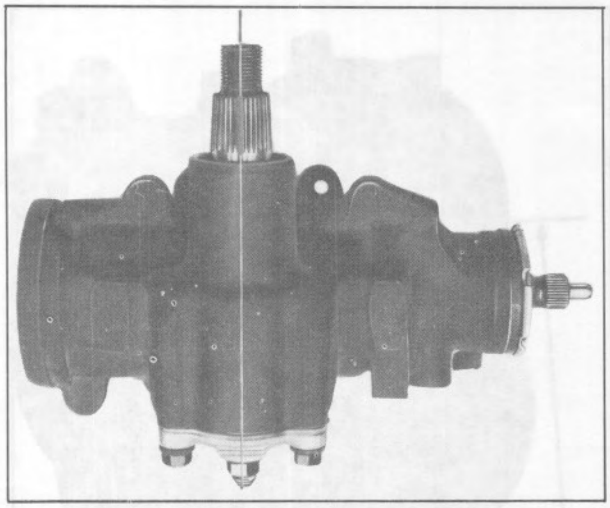


Fig. 9-64 Block Tooth on Pitman Shaft in Line With Over-Center Preload Adjuster

advancing the adjuster plug into the gear assembly.

7. Adjust pitman shaft "over-center" sector as described in Note 16.

16. Pitman Shaft "Over-Center" Sector Adjustment

1. Turn the stub shaft from stop to stop, counting the total number of turns. Divide this number by 2. Starting at either stop, turn the stub shaft 1/2 the total number of turns. This is the "center" of the gear. The flat on the stub shaft is normally up and parallel with the side cover when the gear is "on center", Fig. 9-63, and the block tooth on the pitman shaft is in line with the over-center preload adjuster, Fig. 9-64.

2. Rotate the torque wrench approximately 45 degrees each side of center, and "read" near or on center (highest reading), Fig. 9-60. Loosen the lock nut and turn the preload adjusting screw clockwise until the correct "0" center torque, in excess of the reading just taken, is obtained, Fig. 9-65.

Limits for "new" and "used" gears are different, as follows:

a. "New" gear over-center torque to be 4-8 in. lbs. additional torque, but total over-center torque must not exceed 18 in. lb.

b. "Used" gear 400 or more miles. Over-center torque to be 4 to 5 in. lbs. additional torque, but total over-center must not exceed 14 in. lbs.

Tighten the lock nut to 35 ft. lbs. while holding the preload adjuster screw. Recheck the "0" center adjustment.

17. Steering Gear Line Connector Seats and Poppet Check Valve Replacement

The following procedure can be performed on car as well as on bench.

1. Disconnect pressure and return lines at steering gear and plug lines to prevent loss of fluid.

2. To prevent metal chips from becoming lodged in valve assembly, pack inside of connector seats of pressure and return port housing with petrolatum or equivalent.

3. Tap threads in connector seats, using a 5/16"-18 tap.

CAUTION: Do not tap threads too deep in pressure hose connector seat as tap will bottom poppet valve against housing and damage it. It is necessary to tap only 2 or 3 threads deep.

4. Thread a 5/16"-18 bolt with a nut and flat washer into tapped hole, Fig. 9-66.

5. To pull connector seat, hold bolt from rotating while turning nut off bolt. This will pull connector from housing. Discard connector seat.

(NOTE: It is also possible to remove connector by using a No. 4 screw extractor.)

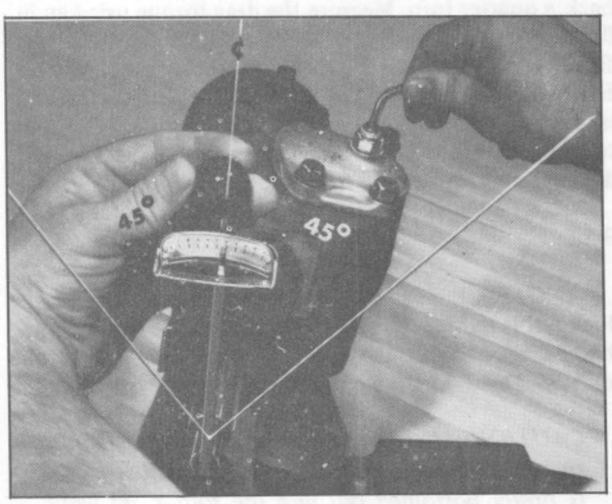


Fig. 9-65 Obtaining Correct "0" Center Torque

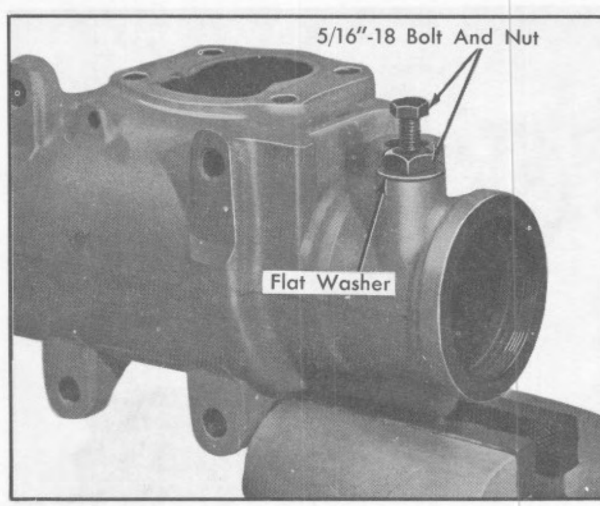


Fig. 9-66 Removing Line Connector Seat

6. Wipe lubricant from housing and clean housing thoroughly to remove any metal chips or dirt.

7. Remove poppet check valve and spring from pressure port and discard.

8. Install new check valve spring in pressure port with large end down. Make sure spring is seated in counterbore in pressure port.

9. Install new check valve over spring with tangs pointing down. Make sure valve is centered on small end of spring.

10. Install new connector seats, using petrolatum or equivalent to hold connector seat on check valve in pressure port. Drive connector seats in place using Valve Connector Seat Installer, J-6217, Fig. 9-67.

11. Check operation of valve by pushing lightly against valve with a small punch or small rod. Valve should reseat itself against connector seat when pressure is removed from spring.

12. Connect pressure and return lines on steering gear. Tighten fittings to 30 foot-pounds.

13. Check fluid in pump reservoir and add if necessary.

18. Removal and Installation of Pitman Shaft Seals—On Car

If upon inspection of the gear, it is found that oil leakage exists at the pitman shaft seals, the seals may be replaced without removing the gear assembly from the vehicle as follows:

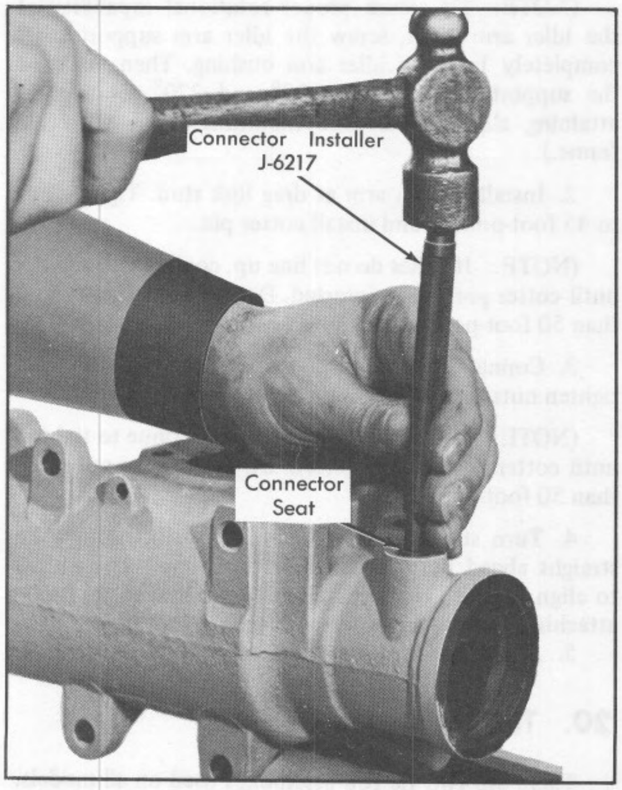


Fig. 9-67 Installing Line Connector Seat

a. Removal

1. Remove pitman nut and disconnect pitman arm from pitman shaft using Puller, J-6632.

CAUTION: Do not hammer on end of puller.

2. Thoroughly clean end of pitman shaft and gear housing, then tape splines on end of pitman shaft to insure that seals will not be cut by splines during assembly.

(NOTE: Use only one layer of tape. An excessive amount of tape will not allow seals to pass, due to close tolerance between seals and pitman shaft.)

3. Remove pitman shaft seal retaining ring with Snap Ring Pliers, J-4245.

4. Start engine and turn steering wheel fully to the left so that oil pressure in the housing can force out pitman shaft seals. Turn off engine.

(NOTE: Use suitable container to catch oil forced out of gear. This method of removing the pitman shaft seals is recommended, as it eliminates the possibility of scoring the housing while attempting to pry seals out. If pressure of oil does not remove seals, turn off engine and pry seals, being careful not to score seal bore in housing.)

b. Installation

1. Inspect seals for damage to rubber covering on O.D. If O.D. appears scored, inspect housing for burrs and remove before attempting new seal installation.

2. Clean end of housing thoroughly so that dirt will not enter housing with the installation of new seals.

3. Lubricate the seals thoroughly with power steering fluid to install seals with Installer, J-6219. Install inner single lip seal first, then back-up washer. Drive seal in far enough to provide clearance for outer seal, back-up washer, and retaining ring. Make sure that the inner seal does not bottom on counterbore. Install outer double lip seal and second back-up washer just far enough to provide clearance for the retaining ring. Install retaining ring.

4. Fill pump reservoir to proper level with power steering fluid. Start engine and allow engine to idle for at least three minutes without turning steering wheel. Turn wheel to left and check for leaks.

5. Remove tape and reconnect pitman arm, tightening nut to 185 foot-pounds.

See CAUTION on page 9-28.

19. Steering Linkage Removal, Disassembly, Assembly, and Installation—Except Eldorado

a. Removal

1. Remove cotter pins from outer tie rod pivots at steering arms and loosen nuts one turn.

2. Remove outer tie rod pivots from steering knuckles using Tie Rod End Puller, J-24319, Fig. 9-68. Be careful not to damage joint seals.

3. Remove idler arm support mounting screws and lockwashers from frame side member.

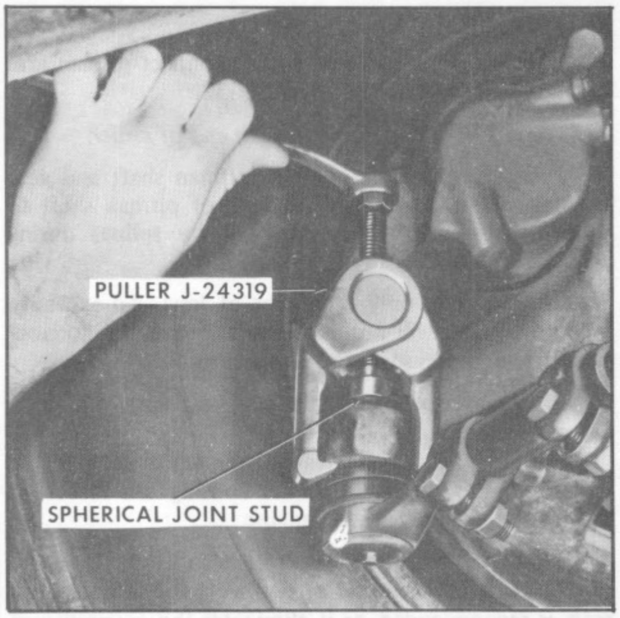


Fig. 9-68 Removing Tie Rod End From Steering Knuckle

4. Remove pitman arm cotter pin, nut and washer at steering linkage.

5. Remove steering linkage from pitman arm, using Puller, J-24319, Fig. 9-19.

6. Remove drag link with tie rods and idler arm attached.

b. Disassembly

1. Remove cotter pins and nuts from idler arm pivot and both inner tie rod pivots.

2. Remove tie rods, using Tie Rod End Puller, J-24319, Fig. 9-69.

3. Remove idler arm from drag link, using Puller, J-24319.

4. Remove dust seals from pitman arm and idler arm pivot studs.

5. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing outer tie rod pivots from adjuster tubes. Be careful not to pull pivot seal off pivot housing.

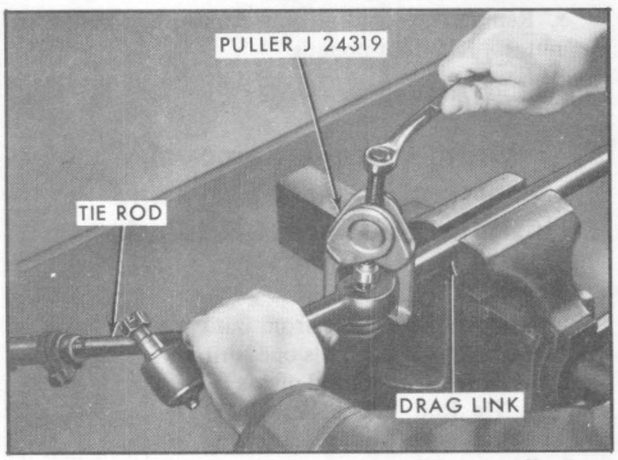


Fig. 9-69 Removing Tie Rod From Drag Link

6. If necessary, remove clamps and adjuster tubes from ends of tie rods.

c. Assembly

1. If previously removed, lubricate adjuster tubes with chassis lubricant. Install adjuster tubes and clamps on ends of rods.

2. Thread outer tie rod pivots into adjuster tubes, but do not tighten outer clamps.

(NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.)

3. Install both tie rods on drag link tightening nuts to 60 foot-pounds, and install cotter pin.

See CAUTION on page 9-28.

4. Install new dust seal on idler arm pivot stud and install idler arm on drag link. Tighten nuts to 40 foot-pounds and install cotter pin.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

5. Install new dust seal on pitman arm pivot stud.

6. Lubricate joints as described in Note 23.

d. Installation

See CAUTION on page 9-28, when performing Steps 2, 3 and 4.

1. Install idler arm support on frame side bar with two mounting screws and lockwashers. Tighten mounting screws finger tight.

(NOTE: To assure proper rotational capability of the idler arm pivot, screw the idler arm support shaft completely into the idler arm bushing. Then, unscrew the support shaft between 90° and 270° rotationally attaining alignment of the mounting holes with the frame.)

2. Install pitman arm at drag link stud. Tighten nut to 45 foot-pounds and install cotter pin.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

3. Connect outer tie rod pivots to steering knuckles, tighten nuts to 37 foot-pounds and install cotter pins.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

4. Turn steering wheel back and forth through the straight ahead position (without touching wheel stops) to align linkage. Then tighten idler arm bracket to frame attaching screws to 35 foot-pounds.

5. Adjust toe-in as described in Section 3, Note 2e.

20. Tie Rods

There are two tie rod assemblies used on all models. Each assembly is of three piece construction, consisting of an adjuster tube and an inner and outer tie rod. The

tie rods are threaded into the adjuster tube and locked with clamps. Right and left hand threads are provided for toe-in adjustment and steering centering.

The tie rods are self-adjusting for wear and require no attention in service other than periodic lubrication and inspection to see that ball studs are tight in the sockets. Replacement of tie rods should be made when excessive up and down motion is evident or if any lost motion or end play at ball end of stud exists.

a. Removal

If any tie rods are replaced front wheel toe alignment must be checked and reset as required to meet specification.

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts.
3. Disconnect tie rod from steering knuckle by using tool J-24319. See Fig. 9-68.
4. Remove inner ball stud from drag link using same procedure as described in Step 2 and 3. See Fig. 9-69.
5. To remove tie rods from the adjuster tube loosen clamp bolts and unscrew end assemblies.

(NOTE: Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 7 foot-pounds, discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.)

b. Installation

1. If the tie rods were removed, lubricate the tie rod threads with EP Chassis lube and thread ends of tie rod into the adjuster tube making sure both ends are threaded and equal distance into the adjuster tube.

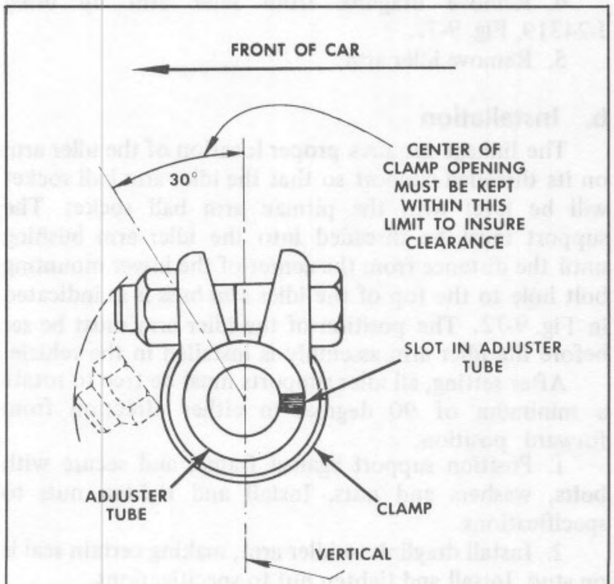


Fig. 9-70 Position of Adjuster Tube Clamp

2. Make sure that threads on ball stud and in ball stud nuts are perfectly clean and smooth. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.
3. If seals were replaced lubricate joint as described in Note 23.

(NOTE: If threads are not clean and smooth, balls studs may turn in tie rod ends when attempting to tighten nut.)

3. Install ball studs in steering knuckle and drag link.
4. Install ball stud nuts and torque to specifications, then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

(NOTE: Before locking clamp bolts on the rods, make sure that the tie rod ends are in alignment with their ball studs by rotating both tie rods in the same direction as far as they will go and tighten adjuster tube clamps to specified torque. Make certain that adjuster tubes and clamps are positioned as shown in Fig. 9-70. Clamp positioning is not required for Cadillac C-D cars.)

5. Remove vehicle from hoist.
6. Adjust toe-in.

21. Drag Link

If drag link is replaced front wheel toe alignment must be checked and reset as required to meet specification.

a. Removal

1. Place vehicle on hoist.
2. Remove inner tie rods from drag link as described in Note 20a.
3. Remove cotter pin and nut from drag link ball stud attachment at pitman arm.
4. Disconnect drag link from pitman arm by using tool J-24319. See Fig. 9-19.
5. Shift steering linkage as required to free pitman arm from drag link.
6. Remove cotter pin and nut from idler arm and remove drag link from idler arm in the same manner as the drag link is removed from the pitman arm in Step 4.

b. Installation

1. Inspect and replace damaged seals as necessary. If seals are replaced, lubricate joint as described in Note 26.
2. Install drag link to idler arm, making certain idler stud seal is in place, then install and tighten nut to specifications. Advance nut just enough to align castellation with cotter pin hole and install pin.
3. Raise end of rod and install on pitman arm. Tighten nut to specifications, then advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Install inner tie rods to drag link as described in Note 20b.
5. Install ball stud nuts and tighten to specifications, then advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.

6. Remove vehicle from hoist.
7. Adjust toe-in and align steering wheel.

22. Tie Rod Adjuster Tube

If tie rod adjuster tube is replaced front wheel toe alignment must be checked and reset as required to meet specifications.

a. Removal

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts on outer tie rod at steering knuckle.
3. Disconnect tie rod from steering knuckle by using a tool such as J-24319. See Fig. 9-68.
4. Unthread outer tie rod end from adjuster tube.
5. Unthread adjuster tube from inner tie rod still connected to draglink.

(NOTE: Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 7 foot-pounds, discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.)

b. Installation

1. Install components in reverse order of removal.
2. Lubricate the tie rod threads with EP Chassis lube and thread ends of tie rod into the adjuster tube making sure both ends are threaded and equal distance into the adjuster tube.
3. Make sure that threads on ball stud and in ball stud nuts are perfectly clean and smooth. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.

(NOTE: If threads are not clean and smooth, ball studs may turn in tie rod ends when attempting to tighten nut.)

4. Install ball studs in steering knuckle.
5. Install ball stud nuts and torque to specifications, then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

(NOTE: Before locking clamp bolts on the rods, make sure that the tie rods are in alignment with their ball studs by rotating both inner and outer tie rods in the same direction as far as they will go and then tighten adjuster tube clamps to specified torque. Make certain that adjuster tubes and clamps are positioned as shown in Fig. 9-68. Clamp positioning is not required for Cadillac C-D cars.)

6. Remove vehicle from hoist.
7. Adjust toe-in.

23. Idler Arm—Except Eldorado

(NOTE: The idler arm assembly should be replaced if when an up and down force of 25 pounds is applied at the drag link end of the idler arm, the vertical lash exceeds 1/8".)

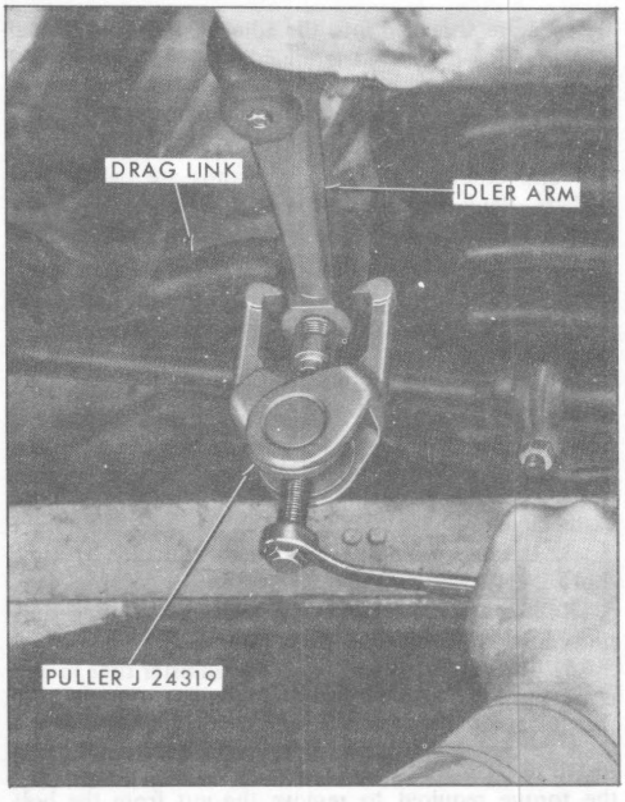


Fig. 9-71 Removing Idler Arm

a. Removal

1. Place vehicle on hoist.
2. Remove idler arm support to frame nuts, washers, and bolts.
3. Remove cotter pin and nut from idler arm to draglink ball stud.
4. Remove draglink from idler arm by using J-24319, Fig. 9-71.
5. Remove idler arm.

b. Installation

The linkage requires proper location of the idler arm on its threaded support so that the idler arm ball socket will be level with the pitman arm ball socket. The support must be threaded into the idler arm bushing until the distance from the center of the lower mounting bolt hole to the top of the idler arm boss is as indicated in Fig. 9-72. The position of the idler arm must be set before the idler arm assembly is installed in the vehicle.

After setting, all idler supports must be free to rotate a minimum of 90 degrees in either direction from forward position.

1. Position support against frame, and secure with bolts, washers and nuts. Install and tighten nuts to specifications.
2. Install draglink to idler arm, making certain seal is on stud. Install and tighten nut to specifications.
3. Advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Remove vehicle from hoist.

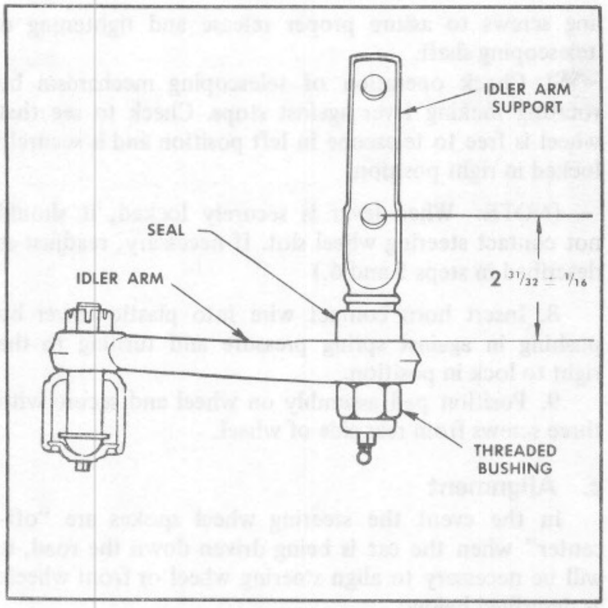


Fig. 9-72 Proper Location of Idler Arm on Threaded Support Bushing, Except Eldorado

24. Pitman Arm—Except Eldorado

Removal

1. Place vehicle on hoist.
2. Remove cotter pin from pitman arm ball stud and remove nut.
3. Remove draglink from pitman arm using tool J-24319. See Fig. 9-19.
4. Remove pitman arm nut and lock washer from pitman shaft and discard. Mark relation of arm position to shaft.
5. Remove pitman arm with Tool J-9172.

CAUTION: Do not hammer on puller.

Installation

1. Install pitman arm on pitman shaft, lining up the marks made upon removal.
2. Install pitman shaft nut and lock washer. Use new nut and lock washer. Torque to specifications.
3. Position draglink to pitman arm. Install nut. Torque to specifications. Continue to tighten nut enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Refer to torque specifications at rear of Section 9 for correct torque valhes.
5. Remove vehicle from hoist.

25. Tie Rod Pivot Seal Replacement

1. Raise car.
2. If replacing outer tie rod pivot seal on Eldorado remove front wheel.
3. Remove cotter pin and nut from outer tie rod pivot.
4. Remove outer tie rod pivot from steering knuckle using Tie Rod Pivot Puller, J-24319, Fig. 9-68. Remove inner tie rod pivot from drag link using Tie Rod Pivot Puller, J-24319, Fig. 9-69.
5. Pry old seal off pivot housing.
6. Wipe pivot and housing clean.
7. Position new seal on pivot stud. Using Seal Installer, J-21150-1, move flange of seal over seat on housing with a firm, even push.

(NOTE: Make certain that seal installer is positioned squarely on seal.)

8. Position tie rod to steering knuckle or drag link and install nut. Tighten nut on outer tie rod pivot to 37 foot-pounds. Tighten inner tie rod pivot nut to 60 foot-pounds.

See CAUTION on page 9-28.

9. Secure pivot nut with cotter pin.

(NOTE: If holes do not line up, continue to tighten nut until cotter pin can be inserted.)

10. Lubricate joint as described in Note 26.
11. If outer pivot seals were replaced on Eldorado, install front wheel.
12. Lower car.

26. Steering Linkage Joint Lubrication

1. Remove service plug from pivot.
2. Using Spherical Joint Repacking Gun, J-9280, repack pivot until grease is expelled at lip of seal.

(NOTE: The installation of a zerk fitting and the use of high pressure grease gun may be required for the threaded idler arm pivot (except Eldorado) to insure that grease is expelled at lip of seal.)

CAUTION: Be sure special spherical joint lubricant is used for this purpose. Ordinary chassis lubricant is not sufficient for this application.

3. Install service plug in pivot.

27. Steering Wheel

a. Removal

CAUTION: Under no circumstances should the steering shaft be struck on the end in an effort to remove the steering wheel. This action will damage delicate parts of the steering column.

1. Remove three screws from back of spokes and lift pad assembly from wheel.
2. Remove horn contact wire from plastic tower by pushing in on wire and turning counterclockwise. Wire will then spring out of tower.

(NOTE: Turn ignition to On to facilitate removal.)

3. On Tilt and Telescope wheel proceed with steps 4 thru 6. On standard wheels proceed to step 7.
4. Remove three screws securing the telescope locking lever assembly to flange and screw assembly.
5. Unscrew flange and screw assembly from steering shaft and remove.

Fig. 9-73 Steering Wheel Removal

6. Remove locking lever assembly.

7. Scribe an alignment mark on steering wheel hub in line with slash mark on steering shaft to be used at time of installation.

8. Loosen nut on steering shaft positioning it flush with end of shaft.

9. Carefully install Steering Wheel Puller, J-1859-03 with two 5/16"-18 x 4" bolts.

10. Tighten center bolt until steering wheel is loose on shaft, Fig. 9-73.

11. Remove puller.

12. Remove steering shaft nut.

13. Lift wheel off steering shaft.

CAUTION: When laying wheel face down, place a cloth on work bench to prevent laminated chrome, wood grain or stripes from being scratched or marked.

b. Installation

1. Install steering wheel, aligning scribe mark on hub with slash mark on end of shaft.

CAUTION: The steering wheel should not be driven on the steering shaft. This action may cause damage to the steering column components.

2. Install steering shaft nut and tighten it to 30 foot-pounds.

See CAUTION on page 9-28.

3. On Tilt and Telescoping columns, proceed to steps 4 through 7. On standard columns, proceed to step 8.

4. Install locking lever assembly on steering wheel.

5. Screw flange and screw assembly finger tight into steering shaft.

6. Position locking lever assembly against flange and screw assembly with lever in vertical position. Secure with three screws. Check operation of lever after tightening screws to assure proper release and tightening of telescoping shaft.

7. Check operation of telescoping mechanism by rotating locking lever against stops. Check to see that wheel is free to telescope in left position and is securely locked in right position.

(NOTE: When lever is securely locked, it should not contact steering wheel slot. If necessary, readjust as described in steps 5 and 6.)

8. Insert horn contact wire into plastic tower by pushing in against spring pressure and turning to the right to lock in position.

9. Position pad assembly on wheel and secure with three screws from rear side of wheel.

c. Alignment

In the event the steering wheel spokes are "off-center" when the car is being driven down the road, it will be necessary to align steering wheel or front wheels as described below:

1. Check steering wheel for proper position on steering shaft. With steering wheel "centered" in car, slot in flexible coupling upper shaft flange should be facing upward with scribe mark on upper end of steering shaft at "12 o'clock". If necessary, reposition steering wheel on shaft.

2. Drive car on a straight flat road to determine whether or not steering wheel is still "off-center".

3. If steering wheel is still "off-center", mark top of the wheel with a small piece of tape or crayon for reference when making correction.

4. Set wheel straight ahead and adjust tie rods. Shorten left tie rod and lengthen right tie rod if top of wheel is to the left of center, or shorten right tie rod and lengthen left tie rod if top of wheel is to the right of center. Be careful not to damage joint seals when adjusting tie rods.

(NOTE: Tie rod adjustment must be made on a wheel alignment machine so that correct toe-in setting is maintained.)

28. Steering Column Removal and Installation

(NOTE: If an electrical problem in the steering column is encountered, steering column analyzer, J-23980, is available as a diagnostic tool.)

a. Removal

1. Center steering wheel to gain access to flexible coupling pinch bolt.

2. Raise hood and disconnect negative battery cable.

3. Disconnect transmission linkage at lower shift lever.

4. Remove clamp screw and lockwasher that secure flexible coupling upper flange to steering shaft on all cars except Eldorado. On Eldorado cars, remove lower steering shaft as described in Note 37a.

5. Remove steering column lower cover as described in Section 12, Note 31.

6. Disconnect turn signal wiring at connector.

(NOTE: If car is equipped with Cruise Control, disconnect harness at this time.)

7. Remove screw securing shift cable to shift bowl.

8. Loosen two vertical bolts at steering column upper support far enough to remove shim packs from either side of support and remove shims.

CAUTION: Do not remove upper support bolts at this time, as column may bend under its own weight.

9. Move rubber carpet seal at toe pan up the steering column as far as possible.

10. Position carpet out of way to gain access to column lower support bracket assembly.

11. Remove six screws securing lower mounting brackets to toe pan.

12. Remove clamp bolt and nut, separate mounting bracket halves and remove bracket assembly.

CAUTION: The lower support bracket assembly must be removed before the upper attachment screws are removed, as column may bend under its own weight.

13. Remove two bolts securing upper column bracket to column support and disconnect ignition and back-up light switch connectors and parking brake release hose.

14. Carefully pull steering column up and out of car, being careful not to damage column mounted switches or dash seal.

(NOTE: If shaft hangs up in flexible coupling,

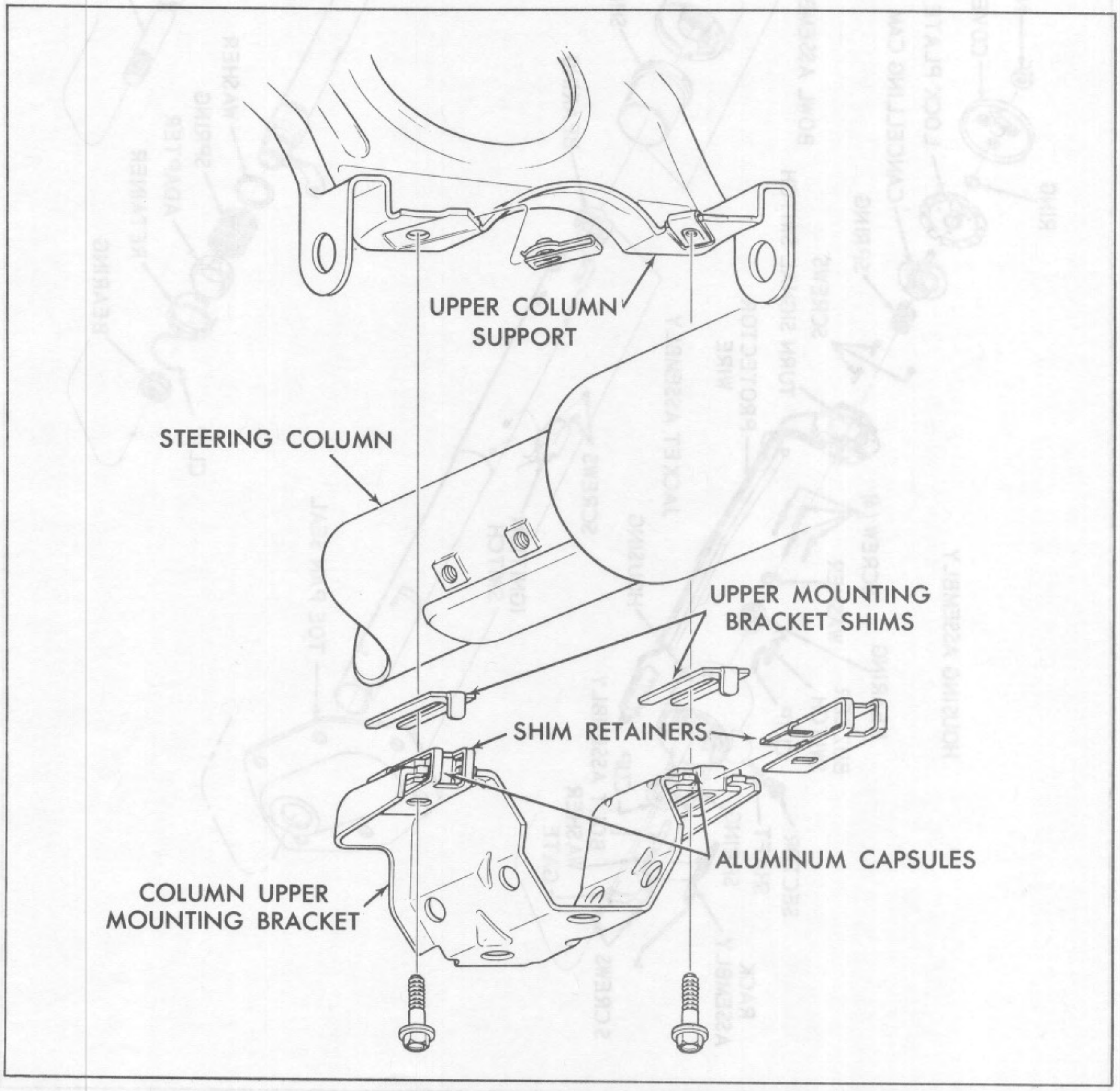


Fig. 9-74 Installing Steering Column Shims

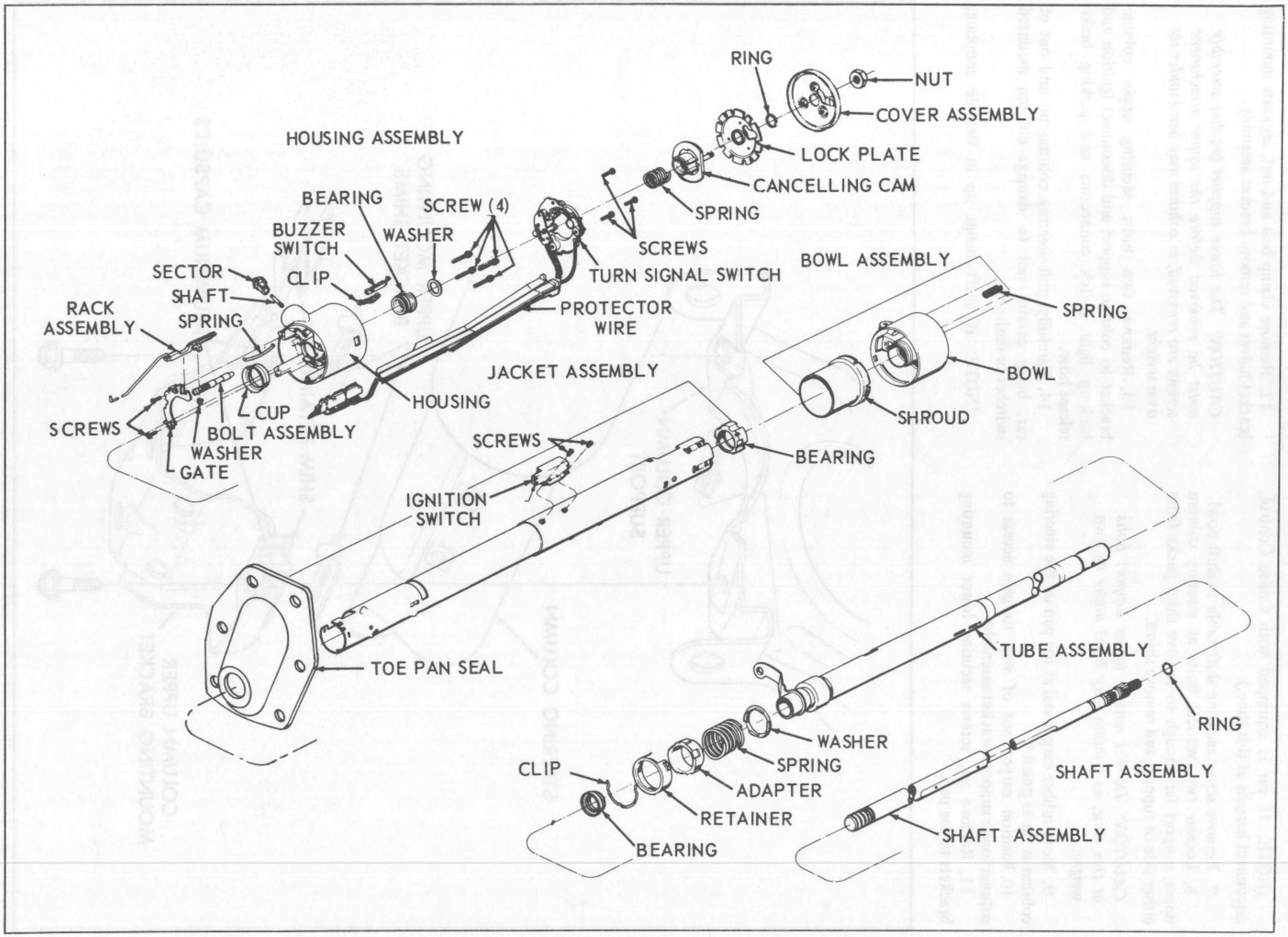


Fig. 9-75 Standard Steering Column Disassembled

reattach upper mounting bracket, then pry stub shaft from coupling with screwdriver.)

CAUTION: When laying wheel face down, place a cloth on work bench to prevent wheel from being scratched or marked.

15. Remove two shim retainers from upper mounting bracket.

b. Installation

1. Install two shim retainers on column upper mounting bracket.
2. If toe pan seal or carpet cover seal were removed, position seals on column.
3. Insert lower end of column through hole in toe pan and into flexible coupling, aligning flat on steering shaft with flat in coupling. Take care to avoid damage to lower shift lever and back-up light switch.
4. Plug in ignition switch connector and install two bolts to secure upper column bracket to upper column support. Do not torque bolts at this time.
5. Install column upper mounting bracket shims in the same location and quantity as found when column was removed, Fig. 9-74.

CAUTION: Place shims on top of shim retainers so that tangs on shims are fully inserted in retainer slot. Shims must not be placed directly against aluminum capsule.

6. Connect back-up light switch connector, parking brake release hose, and turn signal connector.

(NOTE: If car is equipped with Cruise Control, connect Cruise Control wiring harness at this time.)

7. Loosely install six screws securing lower mounting brackets to toe pan.
8. Connect mounting bracket. Clamp halves together and install clamp bolt and nut.
9. Position shift pointer cable to shift bowl and secure with screw. Check for proper alignment.
10. Connect linkage at lower shift lever.
11. Align steering column following procedure outlined in Note 6, steps 7 through 14.

29. Standard Steering Column Disassembly, Inspection, and Assembly—Out of Car (Fig. 9-75)

(NOTE: Extreme care must be taken when working on the column as certain parts of the assembly can be damaged if not handled correctly.)

a. Disassembly

1. Remove steering wheel as described in Note 21a.

CAUTION: When laying wheel facing down, place a cloth on work bench to prevent wheel from being scratched or marked.

2. Remove three screws securing lock plate cover assembly to lock plate and remove cover assembly, Fig. 9-76.
3. Install spring Compressor, J-23131, on steering shaft, Fig. 9-77.
4. Compress lock plate and spring and remove snap ring from groove in shaft, Fig. 9-77. Discard snap ring.

CAUTION: The shaft could slide out bottom of column when snap ring is removed, causing damaged to shaft.

5. Remove lock plate by sliding plate up and off upper shaft.
6. Slide turn signal cancelling cam and upper bearing preload spring off upper steering shaft.
7. Slide thrust washer off upper steering shaft.

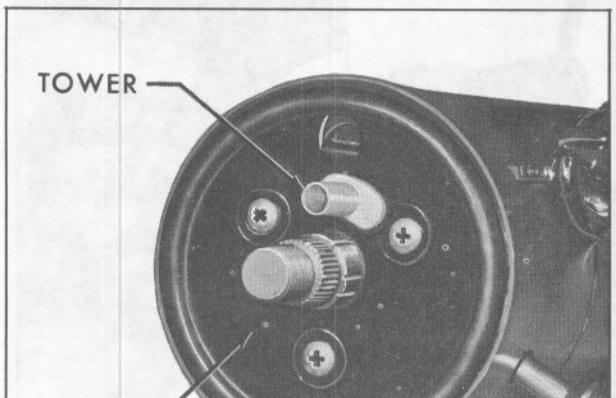


Fig. 9-76 Cover Plate and Tower

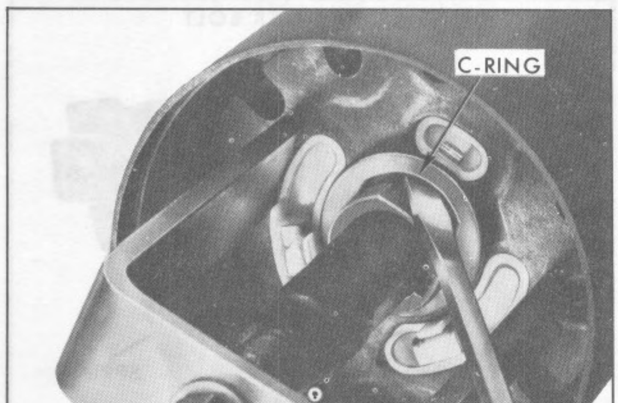


Fig. 9-77 Removing and Installing C-Ring (Standard)

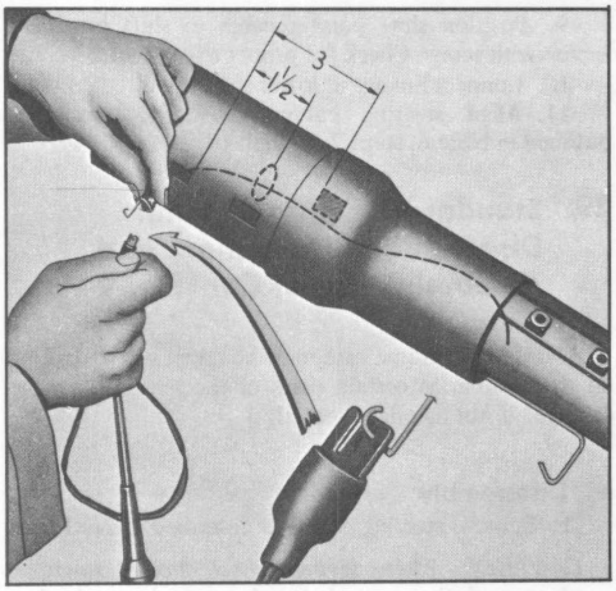


Fig. 9-78 Removing Cruise Control Harness

CAUTION: Care should be taken at this point. Steering shaft is free and could slide out of the column.

8. Push hazard warning switch in, remove cap from knob, remove screw and remove knob from column.

9. Remove turn signal lever screw and remove turn signal lever.

(NOTE: If car being worked on is equipped with Cruise Control, perform the following procedure.)

a. Attach a long piece of piano wire to connector on Cruise Control switch harness, Fig. 9-78.

b. Using extreme care, gently pull Cruise Control harness up through and out of column.

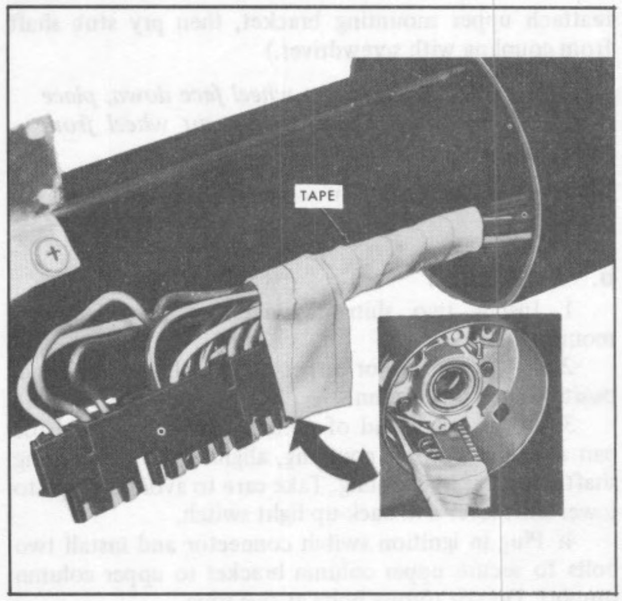


Fig. 9-80 Taping Connector

c. Remove piano wire from harness connector and secure lower end of piano wire to steering column.

(NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column by sliding internal components over wire, to permit location of passages for reassembly.)

10. Remove three turn signal switch mounting screws, Fig. 9-79.

11. Slide turn signal switch connector out of bracket on steering column jacket.

12. Wrap a piece of tape around the turn signal switch connector and harness, Fig. 9-80, to facilitate removal.

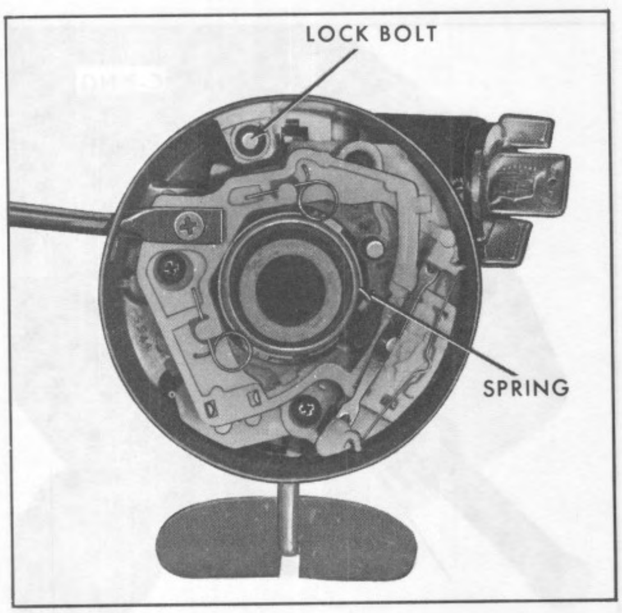


Fig. 9-79 Turn Signal Switch

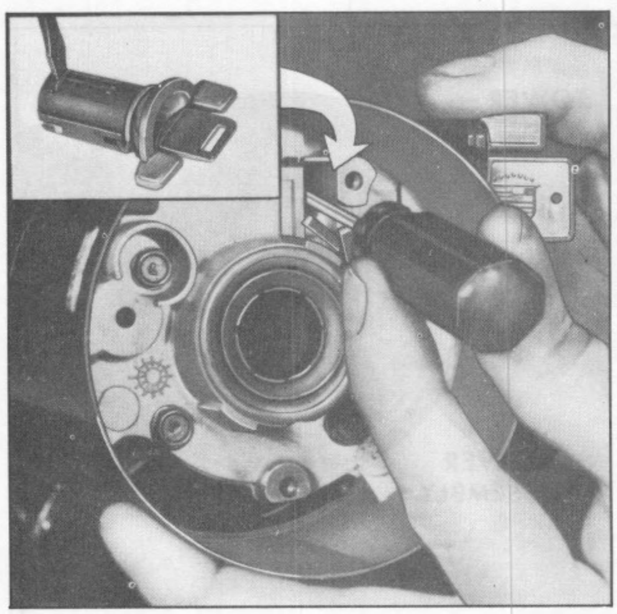


Fig. 9-81 Removing Lock Cylinder

13. Remove four bolts that secure upper mounting bracket to steering column and remove bracket.

14. Free turn signal switch wiring protector from bracket mounting bosses on upper column jacket.

15. Pull turn signal switch straight up with wire protector attached and remove switch, switch harness, and connector from column, Fig. 9-80.

16. Turn ignition switch to the On or Run position.

17. Insert a small, thin screwdriver into slot next to the switch mounting screw boss, Fig. 9-81. Depress lock cylinder retaining tab with screwdriver and remove lock cylinder.

18. Using a piece of stiff wire (such as a paper clip) hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-82. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

19. Pull actuator rod as far as possible, then move rod back two detents.

20. Remove two screws securing ignition switch to lower steering column jacket. Slide switch off actuator rod and remove switch from column.

21. Support upper end of steering column and drive out shift lever pivot pin. Remove shift lever.

b. Upper Housing Diassembly—On Bench (Fig. 9-75)

1. Place shift bowl in Park position.
2. Remove four screws securing upper housing assembly to steering column jacket and remove housing assembly.
3. Remove thrust cap from housing.
4. Remove rack and lock bolt, Fig. 9-83.
5. Remove load spring from housing, and remove shift gate.
6. Remove sector through lock cylinder hole by pushing firmly on block tooth with a blunt punch, Fig. 9-84.

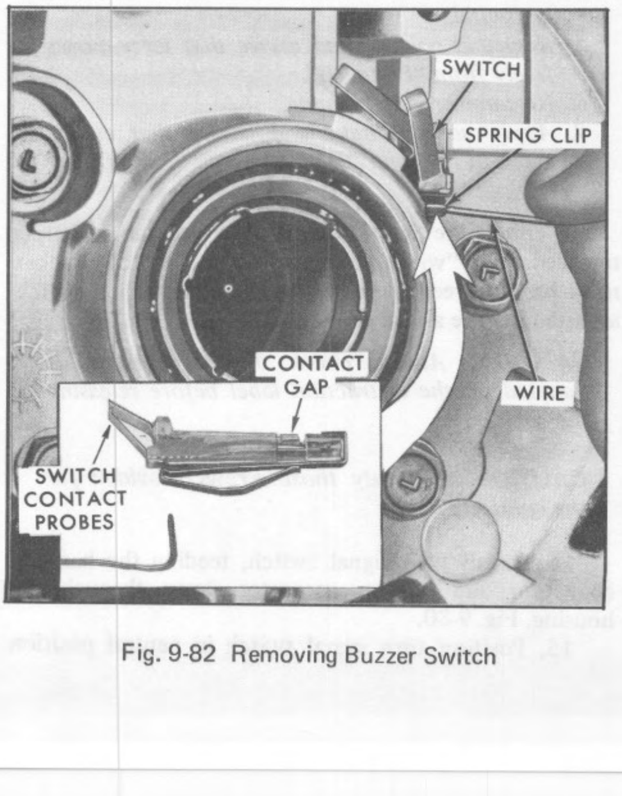


Fig. 9-82 Removing Buzzer Switch

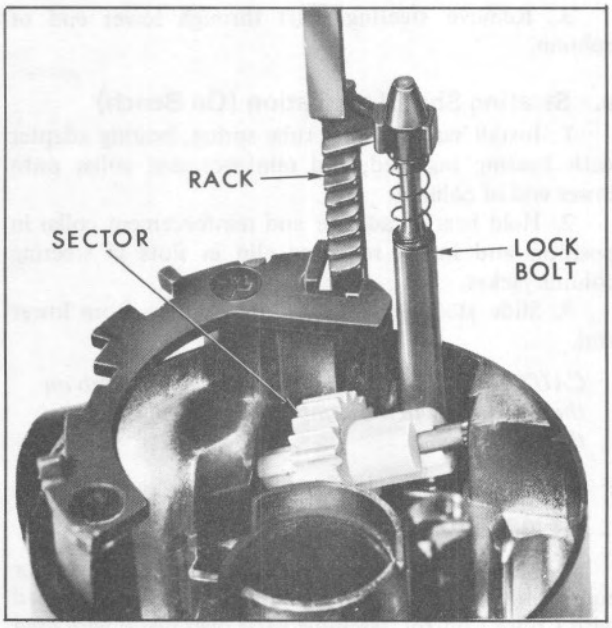


Fig. 9-83 Removing Rack and Lock Bolt

c. Shift Bowl and Shift Tube Disassembly

These parts are not to be removed from outer jacket. Where servicing is required, replace with complete shift bowl, shift tube, and outer jacket assembly.

d. Steering Shaft Removal—On Bench

1. Using a screwdriver, remove lower bearing adapter retaining clip.
2. Slide lower bearing reinforcement collar, bearing adapter and bearing, shift tube spring, and washer off shift tube and out of jacket.

(NOTE: Bearing may be removed from adapter by a light pressing operation on the outer race.)

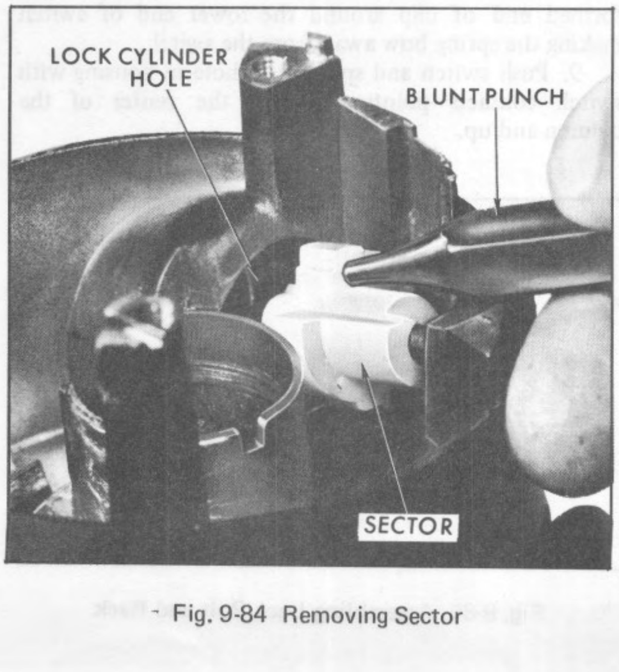


Fig. 9-84 Removing Sector

3. Remove steering shaft through lower end of column.

e. Steering Shaft Installation (On Bench)

1. Install washer, shift tube spring, bearing adapter with bearing installed, and reinforcement collar onto lower end of column.

2. Hold bearing adapter and reinforcement collar in position and install retaining clip in slots in steering column jacket.

3. Slide steering shaft up into column from lower end.

CAUTION: Take care not to hit the drive tab on the back-up switch assembly when sliding shaft up through column.

f. Upper Housing Assembly–On Bench (Fig. 9-75)

(NOTE: Apply a thin coat of lithium grease or equivalent to all friction surfaces. If column is equipped with Cruise Control, assemble parts over piano wire used for disassembly to assure proper installation of Cruise Control harness.)

1. Install sector onto support shaft through lock cylinder hole with drive tang end of sector facing out. Press the sector onto shaft with a blunt punch.

2. Install shift gate in housing.

3. Insert rack spring in housing from bottom side.

4. Assemble lock bolt to cross-over arm of rack, Fig. 9-85.

5. Install rack and lock bolt assembly into the housing from the lower end of housing, with teeth up and toward centerline of column. Make sure wide tooth on sector aligns with wide gap at bottom end of rack.

6. Install thrust cup on bottom hub of housing.

7. Install ignition switch actuator rod through shift bowl and position housing on shift bowl. Secure housing to outer jacket with four screws. Torque to 60 inch-pounds.

8. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch.

9. Push switch and spring into hole in housing with switch contacts pointing toward the center of the column and up.

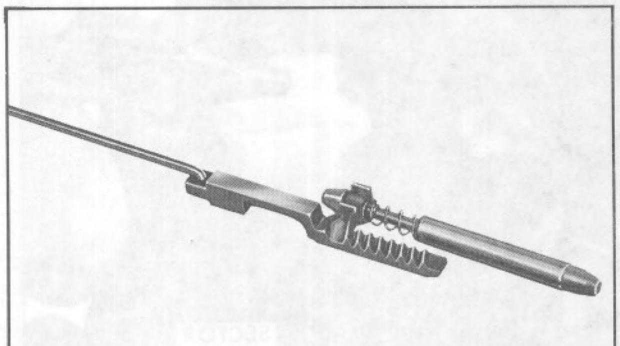


Fig. 9-85 Assembling Lock Bolt and Rack

10. Hold lock cylinder sleeve and rotate key clockwise against stop when viewed from key end. Make sure buzzer switch drive tang is below O.D. of lock cylinder.

11. Insert ignition lock cylinder and sleeve assembly into housing bore with key on cylinder sleeve aligned with keyway in housing. Maintaining a light push inward on cylinder, push until drive section of cylinder touches sector.

12. Rotate key counterclockwise while maintaining inward pressure until lock sector drive engages sector drive. Then, push in until lock cylinder retaining tab pops into groove and lock cylinder is secured in housing. Check freedom of lock cylinder rotation. There must be a free spring return from Start to Run position.

(NOTE: A 1/16" drill shank gage must be inserted between the lock cylinder knob and the column housing to avoid assembling the lock cylinder into the column beyond its normal position.)

13. Assemble ignition switch on actuator rod and adjust to the Lock position.

(NOTE: The Lock position can be found by holding the switch actuating rod stationary with one hand, then moving the switch toward the bottom of the column with the other hand until the end of travel in the switch has been reached. This is the Accessory position. Next back off one detent in the switch and this will be the Lock position. Make sure the ignition key is in the Lock position, then assemble the ignition switch to the column using the two screws provided. Take care to assure proper engagement of drive rod and switch slider without moving from Lock position. Tighten screws to 35 inch-pounds.)

CAUTION: When replacing or adjusting ignition switch:

1. Be sure battery is disconnected.
2. Set switch in OFF-UNLOCKED.
3. Put gearshift in "N".
4. Turn key toward LOCK and hold while installing switch.
5. Re-install column and assure that lever moves freely from "P" to "L".
6. Re-connect battery cable.
7. Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".

If either the ignition switch or column jacket is replaced, any "witness" marks on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

CAUTION: Use only those screws provided for the ignition switch.

14. Install turn signal switch, feeding the harness, connector and harness protector down through the housing, Fig. 9-80.

15. Position turn signal switch in neutral position

and install three screws securing switch to upper housing, Fig. 9-79. Tighten screws to 35 inch-pounds.

16. On cars equipped with Cruise Control, perform the following procedure.

a. Connect Cruise Control harness connector to piano wire used on removal, Fig. 9-78.

b. Feed Cruise Control harness into turn signal lever opening in steering column housing assembly. Next, gently pull on piano wire and pull Cruise Control harness through the steering column and into position.

c. Remove tape from turn signal wire harness.

d. Remove piano wire from harness connector.

e. Position turn signal lever on turn signal switch and secure lever to turn signal switch with one screw. Tighten screw to 35 inch-pounds.

17. Position turn signal switch wiring protector over upper bracket mounting bosses on upper steering column.

18. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws. Tighten screws to 20 foot-pounds.

19. Install turn signal switch connector in bracket on steering column upper jacket.

20. Install hazard warning switch knob.

21. Install thrust washer on steering shaft.

22. Install upper bearing preload spring and turn signal cancelling cam.

23. Install lock plate with large flat on plate aligned with large flat on steering shaft.

24. Place a new snap ring on upper end of steering shaft.

CAUTION: Do not use old snap ring because ring becomes distorted upon removal.

25. Install Spring Compressor, J-23131, on steering shaft, Fig. 9-57.

26. Compress lock plate and spring. Next slide new snap ring down shaft until ring locks in groove in upper end of shaft. Remove spring compressor tool.

27. Position cover assembly on upper end of column and install three screws securing cover to lock plate. Install shift lever.

28. Install steering wheel as described in Note 21b.

29. Install steering column into car as outlined in Note 22b.

30. Steering Column Lower Bearing Removal

a. Removal

1. Remove steering gear from car, following Note 10a, Steps 1 through 7.

(NOTE: If car being worked on is an Eldorado, disregard Step 1 and remove lower shaft as described in Note 37a.

2. Remove lower bearing adapter retaining clip and reinforcement collar.

3. Carefully pry lower bearing and adapter assembly from shaft.

4. Pry bearing assembly out of adapter and discard bearing.

b. Installation

1. Install new lower bearing into bearing adapter.

CAUTION: Make certain that bearing is properly seated in adapter.

2. Install bearing and adapter on shaft and up into steering column lower jacket.

3. Install reinforcing collar over end of jacket.

4. Install retaining clip that holds adapter and collar to jacket.

5. Install steering gear as described in Note 10b, Steps 1 through 6.

(NOTE: If working on an Eldorado, disregard Step 5 and install lower shaft as described in Note 37b.)

31. Steering Shaft

In the event that the two nylon shear pins in the energy-absorbing steering column break due to impact not strong enough to collapse steering column jacket or shift tube, steering shaft must be repaired ONLY in the manner prescribed below.

(NOTE: If jacket or shift tube collapse, column must be replaced as an assembly.)

1. Remove steering column from car as outlined in Note 28a.

2. Remove steering shaft from column as described in Note 29d for standard column or Note 32b, for Tilt and Telescope column.

3. Pull upper solid shaft out of lower tube shaft approximately 3/8" or until a stop is felt. Plastic will be just visible.

(NOTE: It should not be necessary to repair the lower plastic joint in a two-joint shaft.)

4. Obtain a steering shaft repair kit. Kit consists of three snap rings and a supply of special primer and adhesive. Materials in kit are sufficient to service three cars.

5. Wipe shaft clean and dry for about one inch from tube.

6. Spray this area liberally with special primer. Allow not more than 20 minutes to dry.

7. Spread a 3/8" wide strip of special adhesive around primed area of shaft, and push shaft together until proper overall length is obtained.

STEERING SHAFT LENGTHS

	Standard Column	Tilt and Telescope Column
All Except Eldorado	36-31/32	30-13/32
Eldorado	37- 1/16	30-17/32

Allow joint to set up at least five minutes, then wipe off excess adhesive. Adhesive will harden to 350 lbs. yield strength.

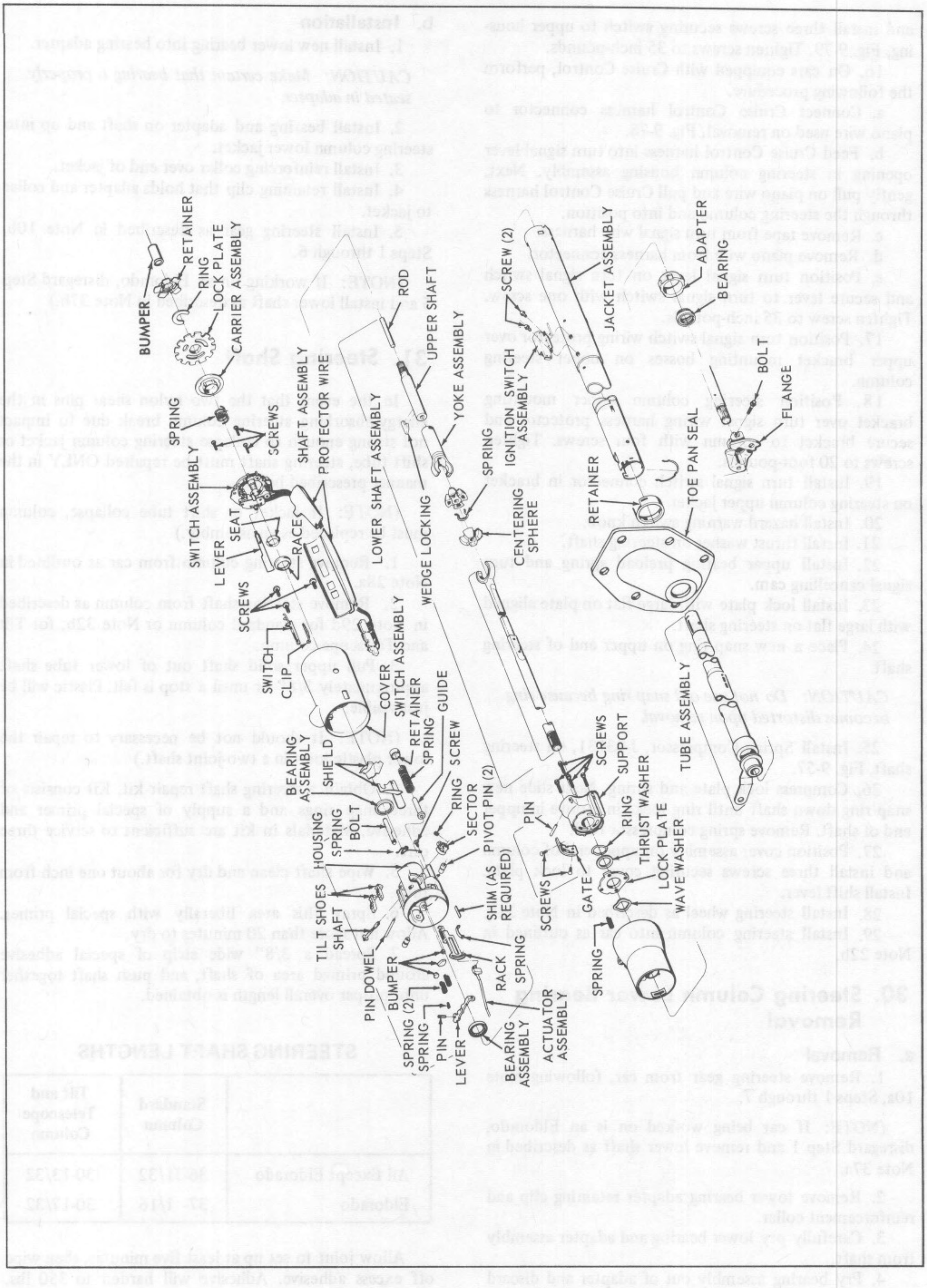


Fig. 9-86 Tilt and Telescope Steering Column Disassembled

8. Install shaft into column using a new snap ring, as outlined in Note 29e for standard column or Note 32h for Tilt and Telescope column.

9. Install column in car, Note 28b.

32. Tilt and Telescope Column Disassembly, Inspection, and Assembly—Out of Car (Fig. 9-86)

(NOTE: Extreme care must be taken when working on the column as certain parts of the assembly may be damaged if handled incorrectly.)

a. Disassembly

1. Remove steering wheel as described in Note 27a.

CAUTION: When laying wheel face down, place a cloth on work bench to avoid scratches or marks on steering wheel.

2. Slide rubber sleeve bumper from steering shaft.

(NOTE: Save rubber sleeve bumper as it must be reinstalled at column assembly. If distorted, it should be replaced with a new bumper.)

3. Remove plastic retainer, using small screwdriver to disengage tabs on retainer from C-ring.

4. Install Spring Compressor, J-22063, on steering shaft, Fig. 9-87 threading bolt into steering shaft telescoping lock hole.

(NOTE: When installing spring compressor, pull upper shaft up 1" from bottomed position, then turn ignition to Lock to hold shaft in place.)

5. Compress upper steering shaft preload spring and remove C-ring, Fig. 9-87.

Fig. 9-87 Removing and Installing C-Ring (T & T)

6. Remove Spring Compressor, J-22063, and remove upper steering shaft lock plate, horn contact carrier and upper steering shaft preload spring.

7. Remove four screws and washers securing upper mounting bracket to column and remove bracket.

8. Slide harness connector out of bracket on steering column jacket.

9. Slide harness protector down to harness connector and remove protector from column.

10. Wrap a piece of tape around upper part of harness and connector, Fig. 9-80.

11. Remove cap from hazard warning flasher button, remove screw and remove button from column.

12. Position shift bowl in park position.

13. Unscrew turn signal lever and remove lever from column.

(NOTE: On cars equipped with Cruise Control, perform the following procedure:)

a. Slide harness protector down to harness connector. Then open protector and remove protector from harness.

b. Attach a piece of piano wire to the switch harness connector.

c. Unscrew turn signal lever, being sure to pass Cruise Control harness over the lever each time the turn signal lever makes one complete turn.

d. Gently pull Cruise Control harness out through turn signal lever opening.

e. Gently pull remainder of harness up through and out of column.

f. Disconnect guide wire from connector and secure wire to column.

(NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column by sliding internal components over wire to permit location of passages for reassembly.)

g. Remove turn signal lever from car.

14. Pull turn signal switch straight up until connector is inside shift bowl. Remove hazard warning flasher lever from switch assembly. Allow switch assembly to hang from column.

15. Turn ignition key to Run position.

16. Insert a small, thin screwdriver into slot next to mounting screw boss, Fig. 9-81. Depress center of lock cylinder retaining tab with screwdriver and remove lock cylinder.

17. Using a piece of stiff wire, hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-82. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

18. Remove tilt release lever.

19. Remove three screws securing cover to upper housing and dislodge cover from housing. Allow cover to rest on turn signal switch.

20. Pull carefully on wiring harness until connector is removed from housing.

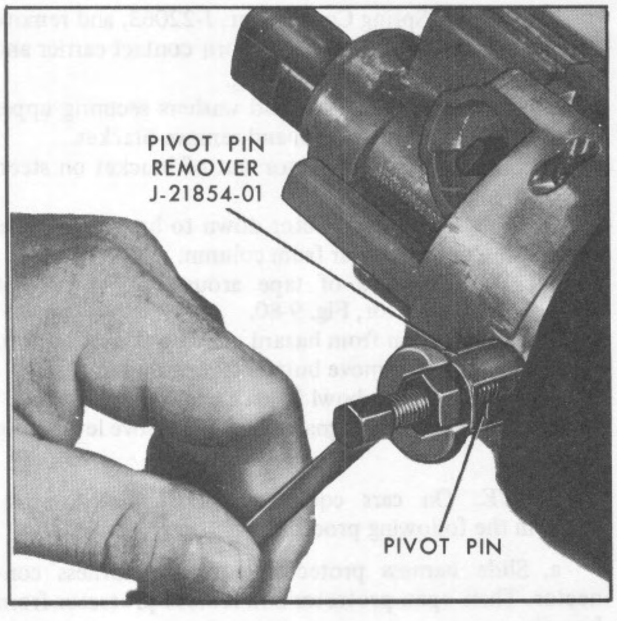


Fig. 9-88 Removing Pivot Pin

21. Install tilt release lever and position housing in full up position.

22. Using a wide bladed screwdriver, remove tilt spring by pushing in and turning spring retaining cap counterclockwise.

23. Remove two screws securing ignition switch to steering column jacket. Slide switch off actuator rod and remove switch from column.

24. Install Pivot Pin Remover, J-21854-01, and remove pivot pins, Fig. 9-88.

25. Pull back on tilt release lever to release upper housing tilt shoes, disconnect actuator rod, and slide upper housing off column. Remove bearing inner race and retainer from upper housing.

26. Remove actuator rod.

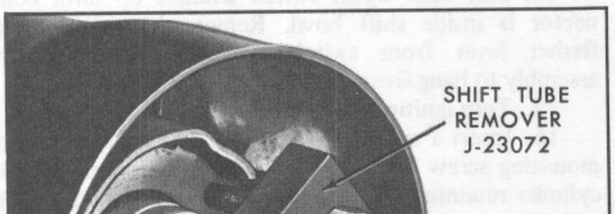


Fig. 9-89 Removing Shift Tube

Fig. 9-90 Lever Opening Shields

b. Steering Shaft and Support Removal

1. Using a screwdriver, dislodge and remove lower steering shaft bearing retainer clip, bearing adapter and bearing.

2. Carefully pull steering shaft out of upper end of column.

3. Remove four screws securing support assembly to steering column and remove support assembly.

4. Turn upper portion of shaft at a right angle (90°) to the lower shaft to disassemble the U-joint.

5. Remove two-piece plastic centering sphere from upper yoke by rotating sphere so flats align with open end of yoke, then remove sphere.

c. Shift Tube Removal

1. Remove one screw and strap securing backup light switch to lower steering column jacket and remove switch.

2. Remove shift tube retainer clip.

3. Secure Shift Tube Remover, J-23072, to plate lock and remove shift tube from column, Fig. 9-89.

CAUTION: Use extreme care when removing shift tube to prevent lower shift lever arm from getting caught at lower end of column jacket resulting in separation of the lower and upper outer jackets at the collapse joint. If separation occurs, a new outer jacket assembly will be required.

4. Remove thrust washer, plate lock, and wave washer and remove shift bowl.

d. Upper Housing Disassembly

1. Remove tilt lever and opening shield and turn

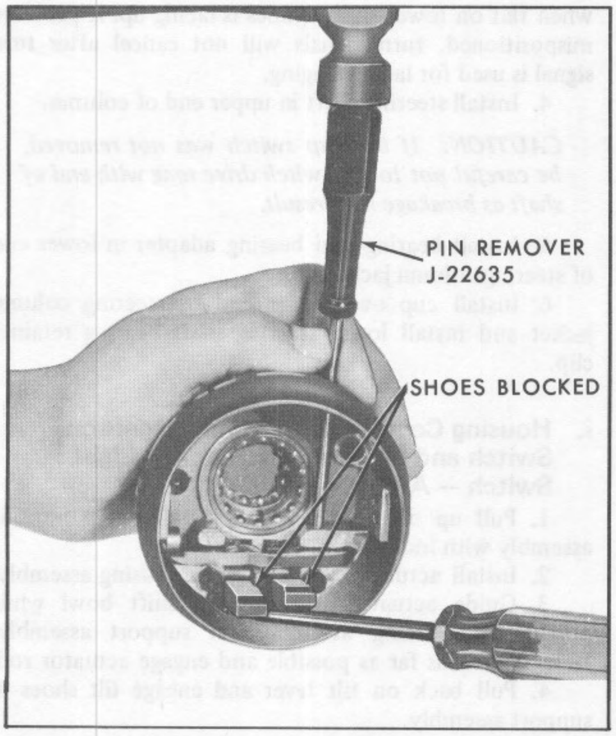


Fig. 9-91 Removing Release Mechanism

signal lever and opening shield from housing, Fig. 9-90.

2. Remove lock bolt spring by removing spring retaining screw. Then, turn spring clockwise and remove spring from bolt.

3. Remove snap ring from sector drive shaft. Using a small punch, lightly tap drive shaft out of sector.

4. Remove drive shaft, sector and lock bolt.

5. Remove rack and rack spring.

6. Wedge shoes inward with a block between top of the shoes, and bearing housing. Using Pin Remover, J-22635, through slot in opposite side of housing, with flat on tool over shoulder next to pin, drive release lever pin out of bearing housing, Fig. 9-91. Remove Pin Remover, J-22635, and remove release lever and spring.

7. Using Pin Remover, J-22635, drive out lock shoe pin. Carefully remove pin remover and remove lock shoes and springs.

(NOTE: With tilt lever opening on left side and shoes facing up, the four slot shoe is on the left.)

e. Inspection

1. Inspect all bearings for wear, roughness and binding. Replace as required.

2. Inspect centering sphere for nicks, damage, and wear. If damage is evident, replace centering sphere.

3. Inspect bearing surfaces of upper shaft for brinelling, nicks, scratches, and wear.

4. Inspect rubber bumpers, making certain they are not torn or damaged.

5. Inspect telescoping mechanism for wear in keyway.

6. Inspect all threads and splines for damage.

7. Inspect locking rod for straightness.

8. Inspect shift bowl for cracks.

9. Inspect steering shaft, shift tube, and outer jacket for signs of damage.

(NOTE: If collapse joint between upper and lower jacket shows movement or is loose, the outer jacket assembly must be replaced.)

10. Inspect all other parts for damage and wear. Replace if necessary.

f. Upper Housing Assembly

1. Apply a thin coat of lithium base (spherical joint) grease or equivalent to all friction parts.

2. Using Pin Remover, J-22635, to line up shoes, install lock shoe springs and lock shoes in upper housing and retain with pin.

(NOTE: With tilt lever opening in housing on left side, and shoes facing up, the four slot shoe is on the left.)

3. Wedge shoes inward with a block between top of shoes and bearing housing. Install spring, release lever, and pin in bearing housing. Remove block from shoes.

4. Install drive shaft in housing, then lightly tap sector onto the shaft far enough to install snap ring. Install snap ring.

5. Install lock bolt and engage sector cam surface.

6. Install rack spring and rack.

(NOTE: Block tooth on rack must engage block tooth on sector.)

7. Install lock bolt spring with "U" shaped arm of spring in the large cavity of the sector and the single wire arm attached to the lock bolt. Install spring retaining screw and tighten to 35 inch-pounds.

8. If removed, install shift lever spring in bowl by winding spring up with pliers and pushing in.

9. Install tilt lever opening shield and turn signal lever opening shield into housing, Fig. 9-90.

g. Shift Tube Installation (On Bench)

1. Install part of Shift Tube Installer, J-23073, in shift tube, Fig. 9-92.

2. Position shift bowl on steering column.

3. Position wave washer in shift bowl.

4. Install plate lock in shift bowl.

CAUTION: Plate lock can be installed backwards by mistake. When installing plate, make sure long flat edge of plate is down and that the long tab is

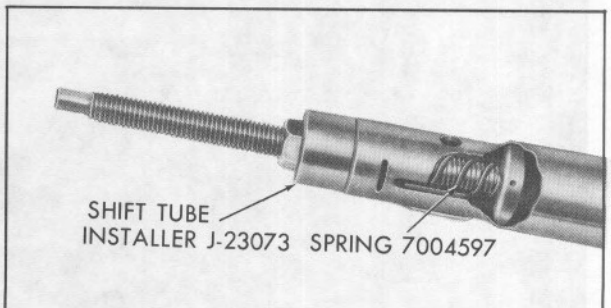


Fig. 9-92 Installing Shift Tube Installer

toward shift lever. This will position the two closely spaced holes to bottom of bowl and the larger spaced holes to the top.

5. Using a grease pencil, locate shift tube key on upper face of Shift Tube Installer, J-23073.

6. Slide shift tube up and into column from lower end of column aligning with keyway in shift bowl.

7. Using alignment marks on Shift Tube Installer, J-23073, align shift tube key with keyway in shift bowl and install remaining parts of Shift Tube Installer, J-23073, Fig. 9-93.

8. Tighten nut on Shift Tube Installer, J-23073, and install shift tube, Fig. 9-93.

CAUTION: When installing shift tube, make sure transmission linkage lever on lower end of tube is centered in slot in lower end of steering column jacket.

9. Remove Shift Tube Installer, J-23073.

10. Install thrust washer on upper end of shift tube.

11. Install snap ring on upper end of shift tube. Snap ring is installed when notches are engaged.

h. Steering Shaft and Support Assembly – Installation

1. Install support assembly by aligning "V" in support with "V" notch in jacket and install four screws securing support assembly to plate lock. Tighten screws to 60 inch-pounds. *See CAUTION on Page 9-28.*

2. Install sphere in upper yoke.

CAUTION: Make sure lash take-up spring (horse-shoe in shape) is properly positioned between spheres before assembling to upper yoke.

3. Rotate centering sphere so that lower steering shaft can be installed over flats on sphere (approximately 90° from center line of upper portion of shaft.) Then install lower shaft coupling over the sphere. Looking along shaft from top make sure keyway faces right

Fig. 9-93 Installing Shift Tube

when flat on lower shaft splines is facing up. If parts are mispositioned, turn signals will not cancel after turn signal is used for lane changing.

4. Install steering shaft in upper end of column.

CAUTION: If back-up switch was not removed, be careful not to hit switch drive tang with end of shaft as breakage may result.

5. Install bearing and bearing adapter in lower end of steering column jacket.

6. Install cup over lower end of steering column jacket and install lower steering shaft bearing retainer clip.

i. Housing Cover, Lock Cylinder, Ignition Switch and Neutral and Back-Up Light Switch – Assembly

1. Pull up on tilt lever and install upper housing assembly with lock bolt toward top.

2. Install actuator rod in rack in housing assembly.

3. Guide actuator rod through shift bowl while positioning housing assembly on support assembly. Extend rack as far as possible and engage actuator rod.

4. Pull back on tilt lever and engage tilt shoes in support assembly.

5. Align pivot pin holes and install pivot pins by hand, then tap them in with a plastic mallet. The column must be supported to prevent any bending forces on the collapse area.

6. If removed, install upper bearing in housing assembly.

7. Install upper bearing inner race and retainer ring.

8. Tilt housing to full up position.

9. Position tilt spring guide, tilt spring, and spring retainer in housing assembly.

10. Using a large screwdriver, press in on tilt spring retainer, compress spring and rotate retainer clockwise until retainer locks in housing.

11. Remove tilt release lever.

12. Position turn signal wiring harness inside steering column cover and insert harness into housing until connector is through shift bowl.

13. Install cover over housing assembly.

14. Check tilt lever and turn signal lever opening shields for proper alignment.

15. Install three screws securing cover to housing assembly. Tighten screws to 110 inch-pounds.

16. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch, Fig. 9-82.

17. Push switch and spring into hole in housing with switch contacts pointing up, making sure that switch is fully installed.

18. Install hazard warning lever in turn signal switch.

19. Finish installing turn signal switch by feeding harness connector through housing, Fig. 9-80.

20. Position turn signal switch in neutral position and install three screws securing switch to upper housing, Fig. 9-79. Tighten screws to 28 inch-pounds.

(NOTE: When properly installed, cancelling springs should be equal distance from steering shaft. If they are

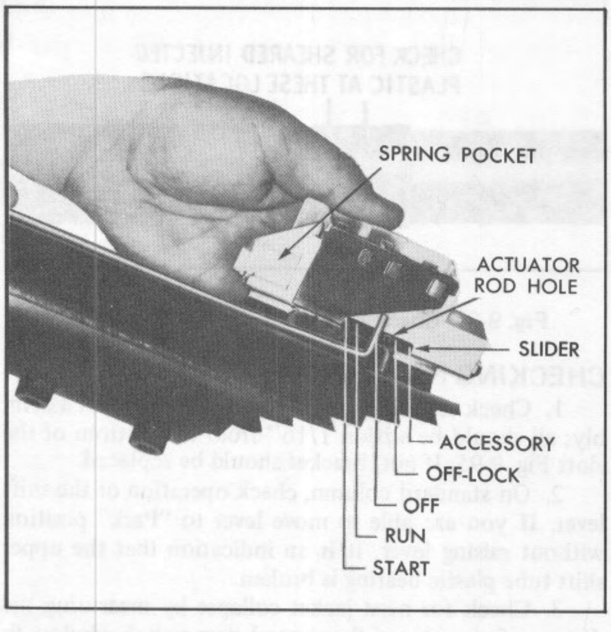


Fig. 9-94 Installing Ignition Switch—T & T Column

not, one turn signal will not cancel when column is reinstalled on car.)

21. Install hazard warning flasher button and check operation.

22. Assemble ignition switch on actuator rod, Fig. 9-94.

CAUTION: When replacing or adjusting ignition switch:

1. *Be sure battery is disconnected.*
2. *Set swtich in OFF-UNLOCKED.*
3. *Put gearshift in "N".*
4. *Turn key toward LOCK and hold while installing switch.*
5. *Re-install column and assure that lever moves freely from "P" to "L".*
6. *Re-connect battery cable.*
7. *Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".*

If either the ignition switch or column jacket is replaced, any "witness" marks Fig. 9-13, on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

23. To install lock, hold lock cylinder sleeve and rotate key clockwise against stop. Make sure buzzer switch drive tang is below O.D. of lock cylinder. Insert cylinder into cover bore with key on cylinder sleeve aligned with keyway in housing until cylinder touches lock sector shaft.

(NOTE: A 1/16" drill shank gage must be inserted between the lock cylinder knob and the column housing to avoid assembling the lock cylinder into the column beyond its normal position.)

24. Maintaining a light push inward on cylinder, rotate cylinder counterclockwise until drive section of cylinder mates with sector drive shaft. Push in until snap ring on lock cylinder pops into groove in housing. Check freedom of rotation of lock cylinder in housing. There must be a free spring return from start to run position.

25. Install turn signal lever.

(NOTE: On cars equipped with Cruise Control, proceed as follows:)

a. Attach guide wire to Cruise Control switch harness connector.

b. Insert harness connector in opening in steering column cover.

c. Gently pull part of harness down through steering column cover part way.

d. Allow turn signal lever to hang free, with approximately 16" of wire out of column. Then rotate turn signal lever in a clockwise direction six times, permitting Cruise Control harness to make six loops.

e. Insert turn signal lever into opening in column.

f. Screw turn signal lever into position, passing the Cruise Control harness over the turn signal lever each time one full turn of the lever is completed.

CAUTION: The harness must be passed over the lever each time the lever makes one complete turn to prevent damaging harness where it enters into the turn signal level. The wire loops will unwind as the lever is screwed in and wires will be straight in the column. Turn lever tight by hand then use a 5/16" wrench to tighten until recess in turn signal lever is facing toward bottom of column.

g. After lever is installed, gently pull remainder of harness through column and into position.

h. Remove guide wire from Cruise Control harness.

i. Install harness protector on harness and slide protector up harness and into position.

j. Connect Cruise Control harness to connector.

26. Attach connector to column.

27. Install upper steering shaft preload spring.

28. Install lock plate and carrier assembly.

(NOTE: When installing lock plate and carrier assembly, make sure flat on lower end of steering shaft is pointing up and that the small plastic tab on the carrier is up or nearest the top of the shift bowl. Flat surface of lock plate must be installed facing down (against turn signal switch.)

29. If upper end of upper shaft hub was removed, replace shaft and wedge at this time.

30. Install Spring Compressor, J-23063, Fig. 9-87. Compress preload spring and lock plate and install C-ring with wide side toward keyway.

31. Remove Spring Compressor, J-23063.

32. Insert plastic retainer on C-ring.

33. Position turn signal switch harness protector over weld nut on upper steering column jacket.

34. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws and washers. Tighten screws to 20 foot-pounds.

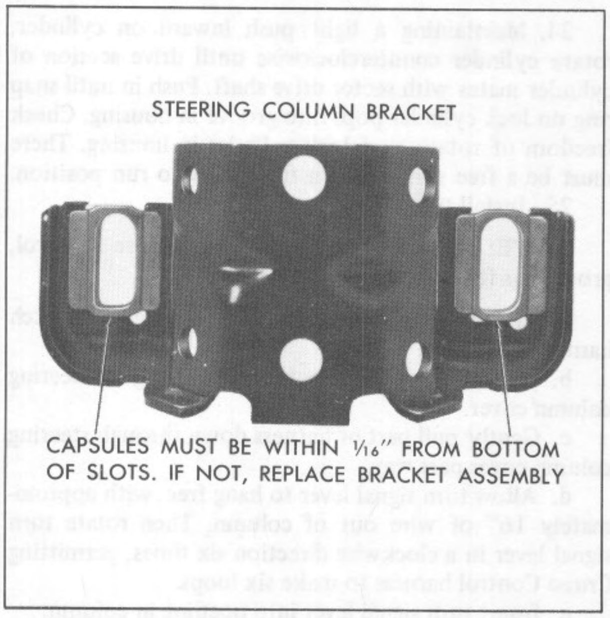


Fig. 9-95 Checking Capsules in Bracket

35. Remove tape from turn signal switch wiring harness and connector.

36. Connect turn signal harness to connector and install connector in bracket on steering column jacket.

37. Slide rubber sleeve bumper over steering shaft.

38. Install steering wheel as described in Note 27b.

33. Checking Steering Column for Accident Damage

(NOTE: Cars involved in accidents resulting in frame damage, major body or sheet metal damage, or where the steering column has been impacted may also have a damaged or misaligned steering column.)

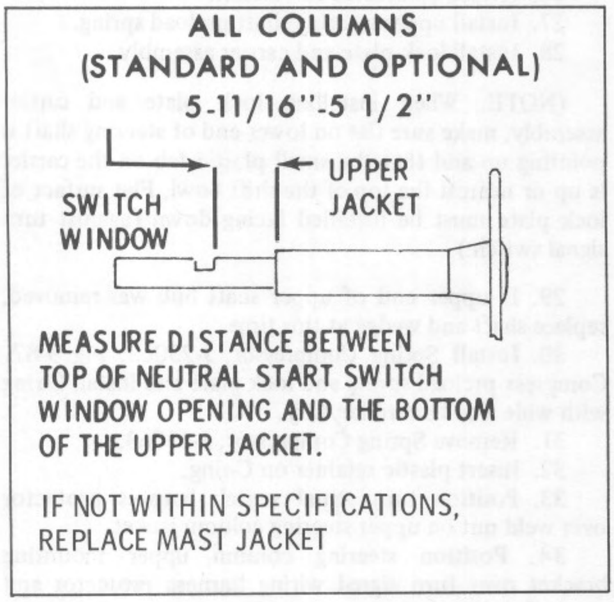


Fig. 9-96 Checking Mast Jacket for Collapse

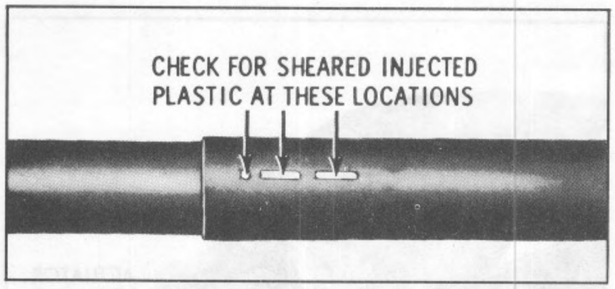


Fig. 9-97 Checking Shift Tube Injected Plastic

CHECKING PROCEDURE

1. Check capsules on steering column bracket assembly; all should be within 1/16" from the bottom of the slots Fig. 9-95. If not, bracket should be replaced.

2. On standard column, check operation of the shift lever. If you are able to move lever to "Park" position without raising lever, it is an indication that the upper shift tube plastic bearing is broken.

3. Check for mast jacket collapse by measuring the distance from edge of the neutral-start switch window to the lower edge of upper jacket. Refer to Fig. 9-96 for dimensions. If mast jacket dimensions Fig. 9-96, are not within specifications a NEW mast jacket must be installed and shift tube and steering shaft visually inspected for sheared injected plastic. If shift tube shows sheared plastic a NEW shift tube must be installed. Fig. 9-97. If steering shaft shows sheared plastic and not bent, it can be repaired by using a Service Steering Shaft Repair Package. Package contains instructions and dimensions for all steering shaft, Fig. 9-98.

4. Check for broken plastic bearing adapter at lower end of steering shaft. If adapter is cracked or broken, it must be replaced.

5. Check steering gear flexible coupling for tears or for no pin engagement. This indicated possible misalignment or frame damage. If flexible coupling damage is evident, the coupling is to be replaced.

6. Any frame damage that could cause a bent steering shaft must have steering shaft runout checked in the following manner: Disconnect the lower shaft at flex-coupling, then remove bolt and nut from clamp of coupling assembly. Remove lower shaft. Hold ruler against lower end of steering shaft and have steering wheel rotated. Runout must not exceed 1/16". Dial indicator may be used instead of a ruler.

(NOTE: This check cannot be made if the bearing adapter is broken.)

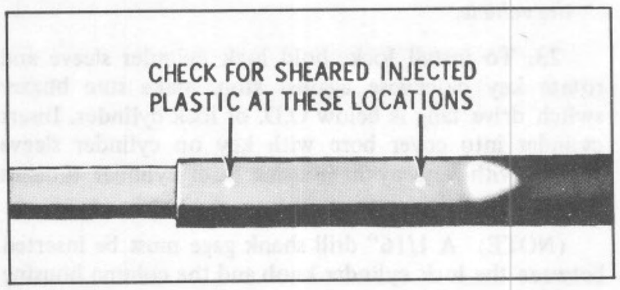


Fig. 9-98 Checking Steering Shaft Injected Plastics

ELDORADO STEERING

The service information that follows pertains only to the Eldorado. All other description, service procedures and recommendations for the Eldorado are the same as those for other cars as given in the first part of this section.

Steering Linkage—Eldorado

The steering linkage on the Eldorado, Fig. 9-99, consists of a pitman arm, idler arm, two tie rod assemblies, a one piece forged steel drag link, and a shock absorber. The pitman arm connects the left side of the drag link to the steering gear and the idler arm connects the right side of the drag link to the frame. The shock absorber connects the drag link to the frame in such a manner as to dampen vibrations in the linkage. The tie rods serve as connecting links between the drag link and the steering knuckles. Tie rod ends should be checked for looseness and damaged seals. Loose tie rod ends must be replaced as a unit. Tie rod seals are replaceable and any damaged seals should be replaced.

34. Steering Gear—Eldorado (Fig. 9-100)

a. Removal

1. Disconnect pressure and return lines from gear. Cap or tape line fittings.
2. Raise car.
3. Remove cotter pin and nut at pitman arm.
4. Disconnect pitman arm from drag link using Puller, J-24319, Fig. 9-101.
5. Remove two screws securing flexible coupling shield to frame side rail and remove shield.
6. Remove two nuts and lockwashers holding flexible coupling together.
7. Remove three screws that hold steering gear to frame side rail, move steering gear forward and downward out of car.
8. Working on bench, remove pitman shaft nut and lockwasher and remove pitman arm from pitman shaft using Pitman Arm Puller, J-6632.

b. Installation

See CAUTION on Page 9-28 when performing steps 1, 2 and 4.

1. Place pitman arm on pitman shaft and install lockwasher and nut on pitman shaft. Tighten nut to 185 foot-pounds.
2. Position steering gear on car and secure to frame side rail with three screws and flatwashers. Tighten screws to 70 foot-pounds.
3. Install nuts and lockwashers that hold flexible coupling together. Tighten nuts to 20 foot-pounds.
4. Install flexible coupling shield to frame side rail and secure with two screws.
5. Install drag link to pitman arm and secure with nut and cotter pin. Tighten nut to 60 foot-pounds and install cotter pin.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.)

6. Uncap pressure and return line hoses and connect to steering gear. Tighten nuts to 30 foot-pounds.
7. Check fluid as outlined in Note 1.

WARNING: WHEN HOSES ARE RECONNECTED BE SURE HOSES DO NOT TOUCH WHEEL HOUSING OR AIR SILENCER AS HOSES MAY BECOME CHAFED AND RUPTURE.

35. Idler Arm—Eldorado

a. Removal

1. Raise car on hoist.
2. Remove cotter pin from idler arm stud and remove nut.

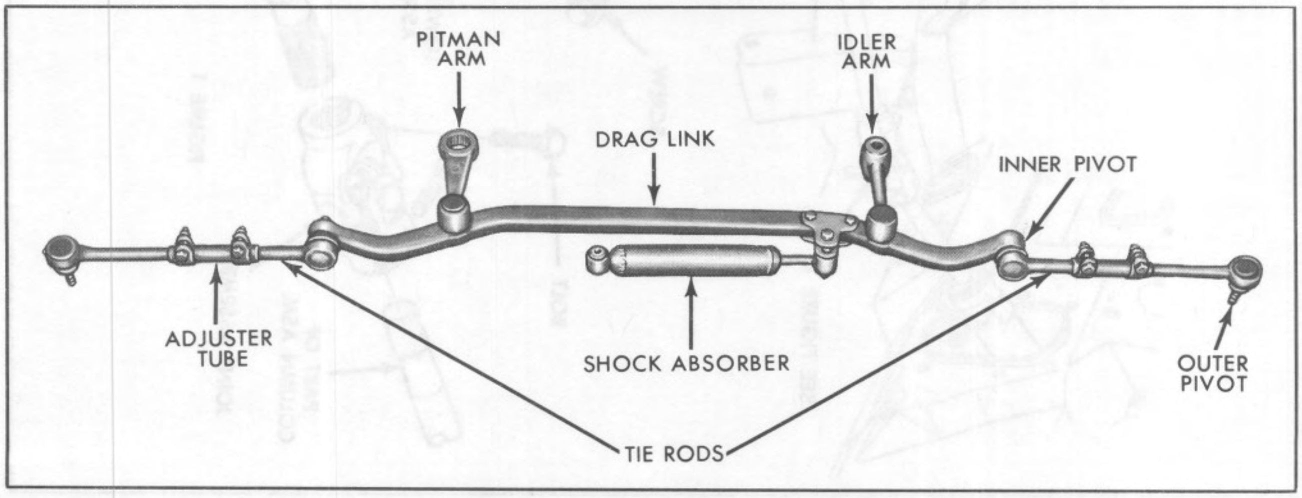


Fig. 9-99 Steering Linkage (Eldorado)

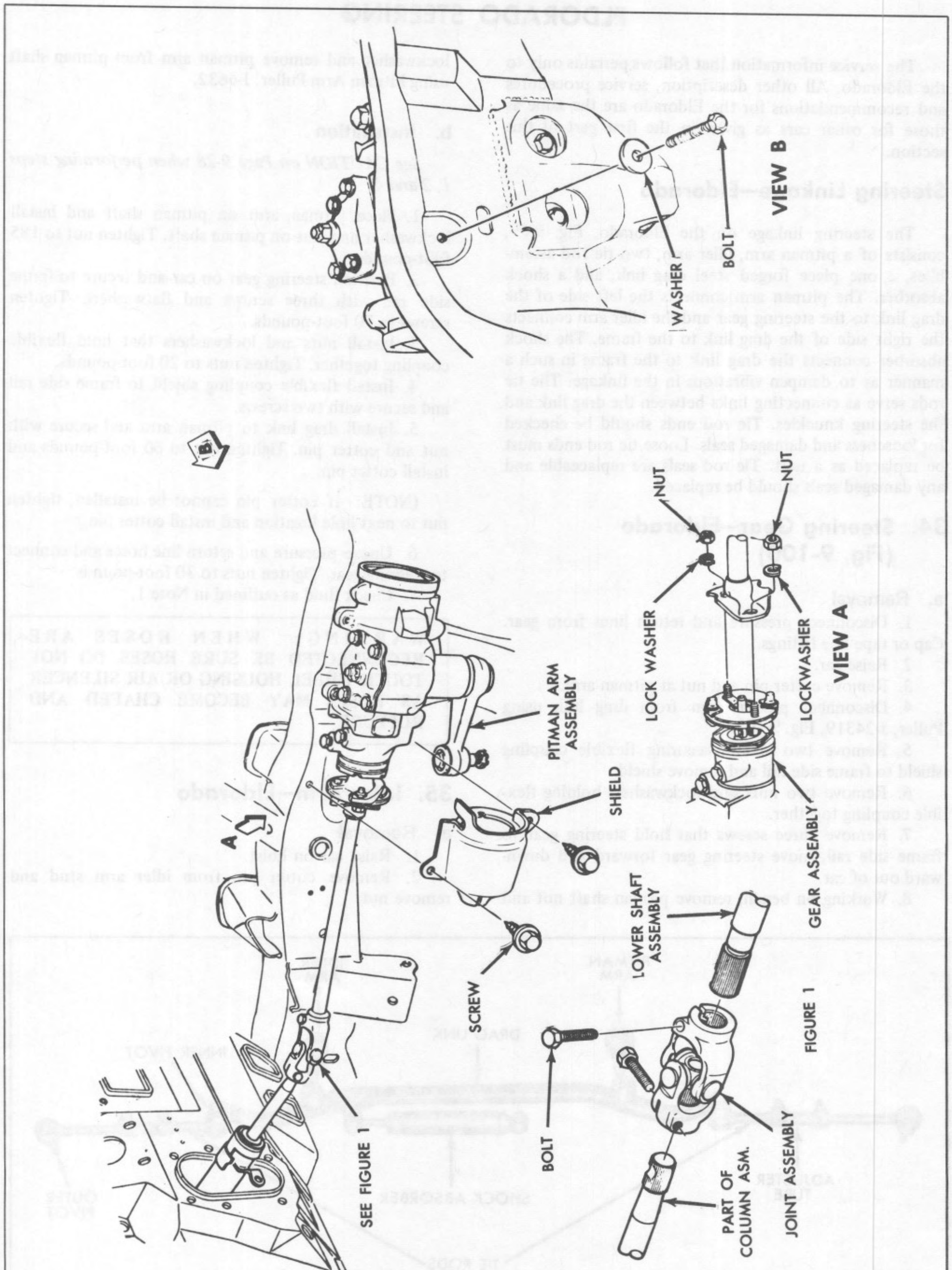


Fig. 9-100 Steering Gear Installation

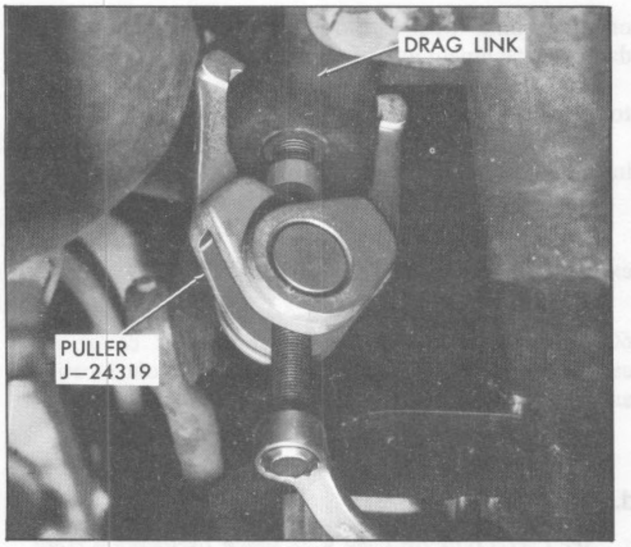


Fig. 9-101 Disconnecting Pitman Arm—Eldorado

3. Remove nut and bolt securing idler arm to frame cross member bracket.

4. Remove idler arm from drag link using Puller J-24319.

b. Installation

1. Install idler arm to drag link and secure with nut. Tighten to 60 foot-pounds and install cotter pin.

2. Install idler arm in frame cross member bracket and secure to bracket with nut and bolt. Tighten to 95 foot-pounds.

3. Lower car.

4. Check steering wheel for being centered.

36. Pitman Arm—Eldorado

a. Removal

1. Remove two plastic retainers securing flexible coupling shield to frame side rail and remove shield.

2. Remove nuts and washers securing flexible coupling.

3. Raise car.

4. Remove pitman shaft nut and washer. Mark position of arm to shaft.

5. Remove cotter pin from pitman arm to drag link stud and remove nut.

6. Disconnect stud from drag link using Puller J-24319.

7. Remove screw securing cooler lines to front cross member.

8. Remove the three steering gear to frame bolts and position gear forward and up far enough to attach Pitman Arm Puller J-6632. Remove pitman arm from shaft.

b. Installation

1. Install pitman arm on pitman shaft and loosely fit into drag link.

2. Install flexible coupling flange into steering shaft flange, loosely install nuts and washers. Check steering wheel and pitman shaft for center on gear.

3. Install steering gear to frame mounting bolts. Tighten to 70 foot-pounds.

4. Tighten pitman shaft nut to 185 foot-pounds.

5. Tighten pitman arm stud nut to 60 foot-pounds and install cotter pin.

6. Tighten flexible coupling flange nuts to 20 foot-pounds.

7. Secure cooler lines to front cross member with screw.

8. Lower car.

9. Install flexible coupling shield and secure with plastic retainers.

10. Start engine and check steering operation.

37. Lower Steering Shaft (Fig. 9-102)

a. Removal

1. Remove two plastic retainers securing flexible coupling shield and remove shield.

2. Remove two nuts and lockwashers and bolts holding flexible coupling together.

3. Remove screw holding flexible coupling to steer-

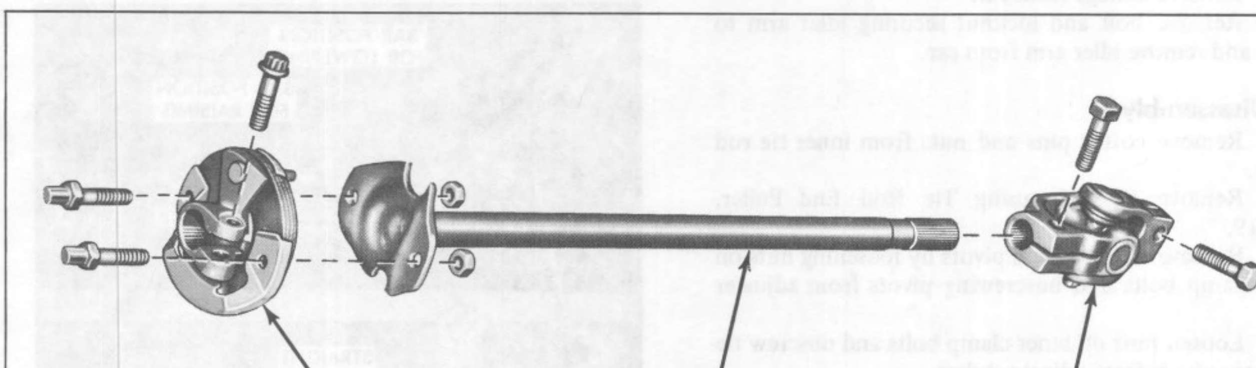


Fig. 9-102 Lower Steering Shaft (Eldorado)

ing gear and shift portion of flexible coupling on gear away from flange on shaft.

4. Disengage flange on shaft from flexible coupling.

5. Remove screw securing universal joint to lower steering shaft and remove shaft from universal joint.

b. Installation

See CAUTION on page 9-28 when performing steps 1, 2, 5 and 6.

1. Insert lower steering shaft into universal joint aligning split in universal joint with flat on shaft. Secure with screw tightened to 80 foot-pounds.

2. Engage flange on shaft to flexible coupling on gear and secure with two bolts, lockwashers and nuts. Tighten nuts to 20 foot-pounds.

3. Install screw securing flexible coupling to steering gear. There should be at least .040 inch clearance between coupling and adjuster plug. Tighten screw to 30 foot-pounds.

4. Install flexible coupling shield and secure with two plastic retainers.

38. Steering Linkage Removal, Disassembly, Assembly, and Installation—Eldorado

a. Removal

1. Remove front wheels.

2. Remove bolt securing steering shock absorber to bracket on frame.

3. Remove cotter pins and nuts from pitman arm and idler arm pivots on drag link.

4. Remove idler and pitman arm pivots from drag link using Puller, J-24319, Fig. 9-101.

(NOTE: It may be necessary to loosen steering gear at frame to remove drag link from pitman arm.)

5. Remove cotter pins and nuts from outer tie rod pivots at steering knuckles.

6. Remove tie rod pivots from steering knuckles using Tie Rod End Puller, J-24319.

7. Remove linkage from car.

8. Remove bolt and locknut securing idler arm to frame and remove idler arm from car.

b. Disassembly

1. Remove cotter pins and nuts from inner tie rod pivots.

2. Remove tie rods using Tie Rod End Puller, J-24319.

3. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing pivots from adjuster tube.

4. Loosen nuts on inner clamp bolts and unscrew tie rod inner pivots from adjuster tubes.

5. Remove bolts securing damper to bracket on drag link and remove damper and spacer.

c. Assembly

1. Position steering damper and spacer to brackets on drag link. Spacer should be positioned between damper attachment and upper part of bracket.

2. Attach damper to bracket with bolt and tighten to 40 foot-pounds.

3. Lubricate adjuster tube with chassis lubricant, install adjuster tubes and clamps on tie rod inner pivots.

4. Thread tie rod outer pivots into adjuster tubes.

(NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.)

5. Install both tie rods on drag link, tighten nuts to 60 foot-pounds and install cotter pins. If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

See CAUTION on page 9-28.

d. Installation

See CAUTION on page 9-28 when performing steps 1, 2 and 3.

1. Install idler arm on frame with bolt and locknut. Tighten bolt to 95 foot-pounds.

2. Install drag link on pitman arm and idler arm pivots and tighten pivot nuts to 60 foot-pounds. Install cotter pins.

3. Install outer tie rod pivots to steering knuckles and tighten nuts to 37 foot-pounds. Install cotter pins.

4. Install damper to frame bracket, tighten bolt to 40 foot-pounds.

5. Install front wheels on car.

6. Adjust alignment as described in Section 3, Note 20.

39. Drag Link Height Adjustment—Eldorado

Drag link height and parallelism should be checked in cases of steering wander and instability after normal correcting adjustments such as standing height, front wheel alignment, etc., have been made. Check drag link height by measuring distance between lower edge of drag link, just inboard of tie rod inner pivots, and centerline of lower control arm inner pivot bolts. The procedure outlined below may be used to measure these distances.

Fig. 9-103 Steering Linkage Parallelism—Eldorado

1. Position car on wheel alignment machine. Place a straight edge midway between drag link and lower control arm and front inner pivots across a level parallel surface, see Fig. 9-103.

2. Measure distance "A" from center line of control arm pivots to top of straight edge.

3. Measure distance "B" from drag link (just inboard of inner pivots) to top of straight edge.

4. The difference between distance "B" and distance "A" should be the same left side to right within 1/8".

5. If not parallel or within 1/8", loosen gear mounting bolts and rotate gear in proper direction to obtain proper height. Tighten mounting bolts to 70 foot-pounds.

See CAUTION note on Page 9-28.

6. If proper height cannot be obtained pry drag link as follows:

a. If the drag link needs to be lowered on the right side install a short piece of chain around the intermediate rod between the right inner pivot and steering damper mounting bolt, see Fig. 9-103. Pry downward with a long bar until proper height is obtained.

b. If the drag link needs to be raised on the right side place the bar under the drag link and pry up, see Fig. 9-103.

7. Adjust front wheel toe in to zero left and right. Center steering wheel with tie rod adjusters.

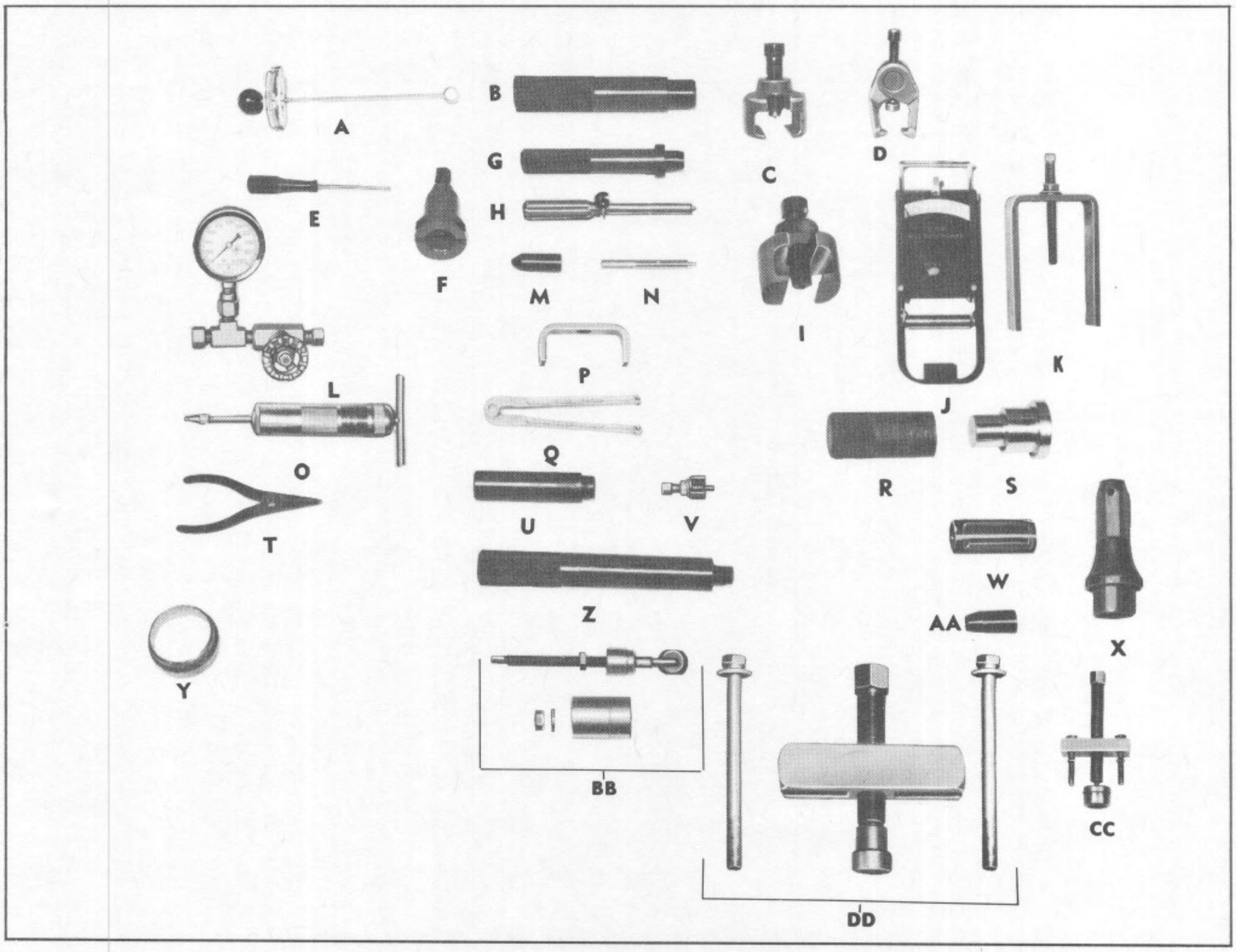
TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot-Pounds
280M	Mounting Bracket to Pump Screw	3/8-16	32
Special	Pump Pressure Unions	5/8-18	32
286M	Pump Pulley Nut	9/16-18	47
260M	Pump Mounting Bracket to Engine Screw	3/8-16	22
*260M	Flexible Coupling Upper Clamp Screw	3/8-24	30
*280M	Flexible Coupling Lower Clamp Screw	3/8-24	30
*286M	Flexible Coupling Nut	5/16-24	20
*286M	Flexible Coupling Nut	3/8-24	20
*300M	Universal Joint Clamp Bolt (Eldorado)	7/16-20	80
Special	Rack-Piston End Plug	1-5/16-16	80
Special	Rack-Piston Ball Guide Clamp Screw	1/4-20	10
280M	Steering Gear Side Cover Screws	3/8-16	30
*300M	Steering Gear to Frame Screw	7/16-14	55
*300M	Steering Gear to Frame Screw (Eldorado)	7/16-14	70
Special	Steering Gear Adjuster Lock Nut	7/16-20	32
*Special	Pitman Shaft Nut	7/8-14	185
*Special	Pitman Arm to Drag Link Nut	1/2-20	45
*Special	Pitman Arm to Drag Link Nut (Eldorado)	1/2-20	60
*Special	Idler Arm to Drag Link Nut	1/2-20	40
*Special	Idler Arm to Drag Link Nut (Eldorado)	1/2-20	60
*Special	Inner Tie Rod Pivot to Drag Link Nut	1/2-20	60
*280M	Idler Arm to Frame Bolt	3/8-24	35
*Special	Tie Rod Adjuster Clamp Nut	3/8-24	22
*Special	Tie Rod Pivot to Steering Knuckle Nut	1/2-20	37
*Special	Tie Rod Pivot to Steering Knuckle Nut (Eldorado)	1/2-20	37
Special	Upper Mounting Bracket to Steering Column Screw	5/16-18	20
*301M	Steering Wheel Nut	9/16-18	30
*280M	Idler Arm to Frame Bolt (Eldorado)	5/8-11	95
*280M	Steering Shock Absorber to Frame or Bracket Bolts (Eld.)	7/16-14	40
*300M	Steering Shock Absorber Bracket to Drag Link Bolt (Eld.)	5/16-18	17
*301M	Steering Shock Absorber Bracket to Drag Link Nut	5/16-18	17
Special	Upper Mounting Bracket to Dash Support Screw	5/16-18	20
			Inch-Pounds
6010M	Turn Signal Lever Screw	#8-32	20
Special	Lower Mounting Bracket Clamp Screw	5/16-18	48
1020	Tilt and Telescope Support Screws	#12-28	50
Special	Lower Mounting Bracket to Toe Pan Screws	5/16-18	38
Special	Ignition Switch to Jacket		35

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classification.)

***CAUTION:** *This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

SPECIAL TOOLS



Key	Tool No.	Name	Key	Tool No.	Name
A	J-7754	Torque Wrench (0-25 inch-pounds)	R	J-6219	Pitman Shaft Seal Installer
B	J-6657	Pitman Shaft Bearing Remover	S	J-22407	Pitman Shaft Bearing Installer
C	J-9172	Pitman Arm Puller (C-Car)	T	J-4245	Snap Ring Pliers
D	J-24319	Front Suspension Puller	U	J-6221	Adjuster Plug Bearing Remover and Installer
E*	J-22635	Pin Remover			
F	J-21883	Pump Pulley Puller	V*	J-21854-01	Hardened Step Screw and Pivot Pin Adapter
G	J-5188	Adjuster Plug Seal Installer			
H	J-21552	Rack-Piston Arbor	W	J-7728	Pump Shaft Oil Seal Installer
I	J-6632	Pitman Arm Puller (Eldorado)	X	J-21150	Seal Installer
J	J-23600	Belt Tension Gage	Y	J-7576	Rack-Piston Seal Compressor
K*	J-23063	Carrier and Spring Compressor	Z	J-8092	Universal Handle
L	J-5176-01	Pressure Testing Gage Assembly	AA	J-6222	Adjuster Plug Seal Protector
M	J-22616	Pump Shaft Oil Seal Protector	BB*	J-23073	Shift Tube Installer
N	J-6217	Valve Connector Seat Installer	CC*	J-23072	Shift Tube Remover
O	J-9280	Packing Gun	DD	J-1859-03	Steering Wheel Puller
P	J-23131	Carrier and Spring Compressor			
Q	J-7624	Spanner Wrench			

*Denotes Tilt and Telescope column only.

Fig. 9-104 Special Tools

GENERAL DESCRIPTION

Wheels

The wheels have a drop center rim design. They are secured to the hub by five right hand threaded nuts.

Tires

The original equipment tires installed are selected to provide the best all around tire performance for normal operation. They are designed to operate satisfactorily with loads up to and including the specified full rated load capacity of the car when inflated as recommended in the Tire Usage and Inflation Pressure Table, Fig. 10-1. White sidewall tires are provided as standard equipment on later 1974 model cars.

WHEEL, VALVE AND FASTENING TABLE

Wheel, Valve, and Fastening Table	Calais, De Ville, and Brougham	Fleetwood Seventy Five Commercial Vehicle	Eldorado
Wheel Size and Flange Type	15x6JK	15 x 6JK	15x6JK
Spider to Rim Attachment	Spot Welded	Riveted	Riveted
Offset (Rim Center Line to Mounting Surface)	.29 In.	.29 In.	3.31 In.
Wheel Identification	SC	SB	SD
Valve Stem	T.R. 413 or T.R. 418	T.R. 413 or T.R. 418	T.R. 417
(Number of Fasteners), Bolt Circle	(5), 5.0 In.	(5), 5.0 In.	(5), 5.0 In.
Fastener Torque	130 ft. lbs.	130 ft. lbs.	130 ft. lbs.

MODEL	TIRE USAGE	INFLATION PRESSURES For All Loads Including Full Rated Load	INFLATION PRESSURES For Reduced Loads
Calais, DeVille	L78-15 or LR78-15 Load Range B	6 passengers plus 200 lb. trunk load (1100 lb. total) FRONT-24 REAR-28	1 to 5 passengers (750 lb. total) FRONT-23 REAR-23
Fleetwood Sixty Special Brougham	L78-15 or LR78-15 Load Range B	6 passengers plus 200 lb. trunk load (1100 lb. total) FRONT-24* REAR-28	1 to 5 passengers (750 lb. total) FRONT-24* REAR-24
Eldorado	L78-15 or LR78-15 Load Range B	6 passengers plus 200 lb. trunk load (1100 lb. total) FRONT-27* REAR-22	1 to 5 passengers (750 lb. total) FRONT-26* REAR-20
Fleetwood Seventy-Five	L78-15 or LR78-15 Load Range D	9 passengers plus 200 lb. trunk load (1550 lb. total) FRONT-30 REAR-36	1 to 5 passengers (750 lb. total) FRONT-27 REAR-27
Commercial Vehicle	8.90-15 Load Range D	For all loads up to gross vehicle weight FRONT-28 REAR-40	—

*Add 1 psi if equipped with air cushion restraint system option.

Fig. 10-1 Tire Usage And Inflation Pressure Table

The new Space Saver Spare Tire is optional on all cars except limousines and commercial vehicles. It is equipped with a safety relief valve to provide protection against the potential hazard of overinflation. It has an approximate tread life of 2,000 miles, therefore, its continued use other than for emergency purposes is not recommended. Speeds above 50 MPH are not recommended. The Space Saver Spare has the same warranty as all original equipment tires. However, this warranty is void if any inflator containing sealants is used. Approved inflation gases are air, carbon dioxide, nitrogen and refrigerant 22.

SERVICE INFORMATION

1. Proper Inflation Pressure

Do not add air just because "tires look soft" – this may over inflate tires which can result in adverse vehicle ride and handling, and increased susceptibility to damage by road impacts. Radial tires have a larger bulge near their contact with the road due to their lower vertical stiffness as compared to bias belted tires. They look "soft" even when properly inflated.

Too little air pressure can result in abnormal tire wear, adverse vehicle handling and reduced fuel economy. It also causes the tire to flex more each time it goes around, and this builds up excessive heat which weakens the tire and can result in sudden tire air loss.

Check tires at least monthly and carry the inflation pressure recommended in Fig. 10-1, for the maximum expected load to be carried. Adjust as required for additional load to be carried. The sidewall of the tire is marked to show maximum tire load (at maximum inflation). Never surpass this load limit, or damage to tires may result.

Be sure to reinstall valve caps. The caps prevent dirt and moisture from getting into the valve core which could cause air leakage.

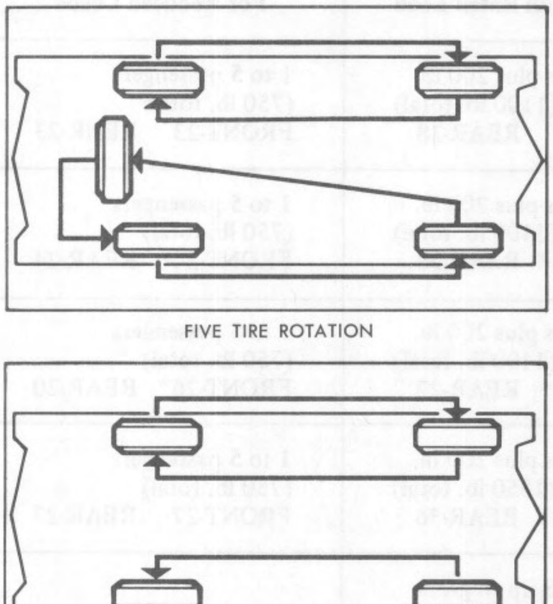


Fig. 10-2 Tire Rotation

2. Tire Rotation

To maximize tire tread mileage and equalize tire wear, it is recommended that tires be rotated at 12,000 mile intervals for radials, 6,000 for standard tires and more often if uneven tire wear is noted earlier.

Front and rear tires perform different jobs and can wear at different rates depending on road condition and individual driving habits such as:

1. Rapid acceleration, causing slippage of the driving wheels.
2. High speed cornering.
3. Severe cornering.
4. Unusually abrasive road surfaces.

A suggested rotation interval for the Eldorados operated under these extreme operating conditions is every 4,000 miles.

All tires should be rotated according to the pattern shown in Fig. 10-2. Inspect tires prior to rotating, and adjust tire pressures (front and rear) after rotation in accordance with recommendations in the Tire Usage and Inflation Pressure Table, Fig. 10-1.

3. Tire Inspection

Tires should be inspected at 6,000 mile intervals so that any irregular wear can be detected. A decrease in traction, anti-skid properties, and road hazard resistance occurs as tires become worn. The original equipment tires incorporate built-in tread wear indicators to assist

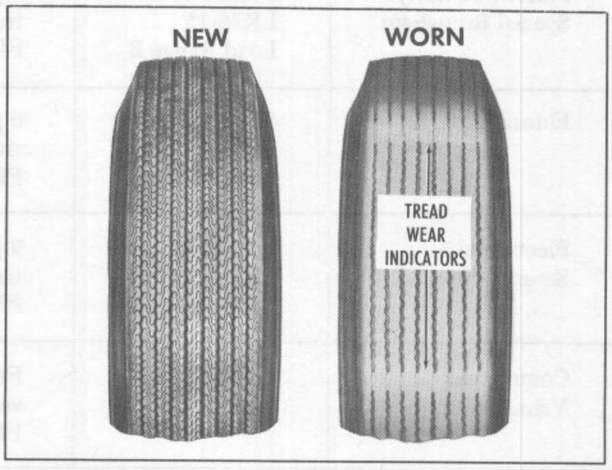


Fig. 10-3 Tread Wear Indicators

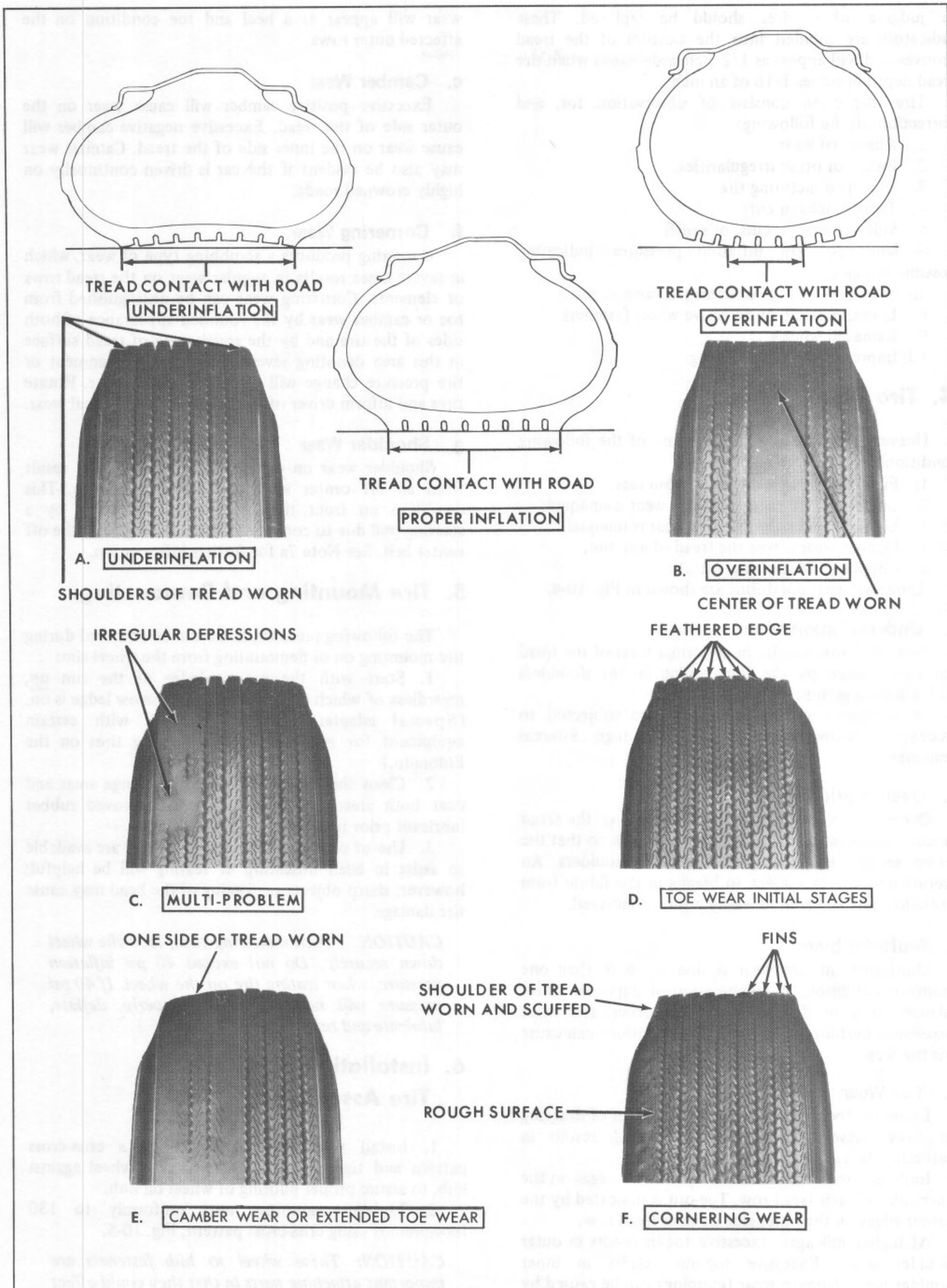


Fig. 10-4 Tire Wear Patterns

in judging when tires should be replaced. These indicators are molded into the bottom of the tread grooves and will appear as 1/2 inch wide bands when tire tread depth becomes 1/16 of an inch.

Tire inspection consists of observation for, and correction of, the following:

1. Abnormal wear.
2. Bulges or other irregularities.
3. Objects puncturing tire.
4. Tread cracks or cuts.
5. Sidewall cracks, cuts, or scuffs.
6. Unusually low inflation pressures, indicating possible leakage.
7. Missing valve caps or damaged valve stems.
8. Loose, missing, or defective wheel fasteners.
9. Damaged wheels.
10. Improper tire size or rating.

4. Tire Wear

Uneven tire wear is defined as any of the following conditions:

1. Front tire wear is different from rear.
2. Left front and right front tire wear is unequal.
3. Left rear and right rear tire wear is unequal.
4. Uneven wear across the tread of any tire.
5. Cupping, flat spotting, etc.

Abnormal wear condtions are shown in Fig. 10-4.

a. Underinflation Wear

Underinflation results in abnormal wear of the tread shoulder, caused by the tires rolling on the shoulders with a wiping action.

In addition, underinflated tires are subjected to excessive flexing, causing damaging high internal temperatures.

b. Overinflation Wear

Overinflation causes the center section of the tread to receive excessive driving and braking loads, so that the center section is worn more than the shoulders. An overinflated tire is subject to breaks in the fabric from severe impacts and is more easily cut or punctured.

c. Multi-Problem

Multi-problem tire wear is due to more than one abnormal condition. A combination of improper wheel balance, worn or defective shock absorbers and worn suspension bushings or all of these conditions can cause this tire wear.

d. Toe Wear

Excessive toe-in or toe-out has the effect of dragging the tires sideways down the road, which results in feathering the raised portions of the tread.

Improper toe-in is indicated by feather edges on the inner side of each tread row. Toe-out is indicated by the feather edges on the outer side of each tread row.

At higher mileages, excessive toe-in results in outer shoulder wear. Excessive toe-out results in inner shoulder wear. Uneven wear (cupping) can be caused by excessive toe-in or toe-out.

On aggressive tread design (block type elements) toe wear will appear as a heel and toe condition on the affected outer rows.

e. Camber Wear

Excessive positive camber will cause wear on the outer side of the tread. Excessive negative camber will cause wear on the inner side of the tread. Camber wear may also be evident if the car is driven continually on highly crowned roads.

f. Cornering Wear

Cornering produces a scrubbing type of wear, which in severe cases results in angular wear on the tread rows or elements. Cornering wear can be distinguished from toe or camber wear by the rounded appearance of both sides of the tire and by the roughening of tread surface in this area denoting severe abrasion. No alignment or tire pressure change will relieve cornering wear. Rotate tires and inform driver of the causes of the unusual wear.

g. Shoulder Wear

Shoulder wear on one front or rear tire can result from an off center steel belt on a radial tire. This condition on front tires may be accompanied by a steering pull due to conicity forces resulting from the off center belt. See Note 7a for further information.

5. Tire Mounting and Demounting

The following precautions should be observed during tire mounting on or demounting from the wheel rim:

1. Start with the narrow ledge of the rim up, regardless of which side of wheel the narrow ledge is on. (Special adapters may be required with certain equipment for mounting or demounting tires on the Eldorado.)

2. Clean the rim in the ledge and flange areas and coat both areas thoroughly with an approved rubber lubricant prior to mounting.

3. Use of one of several devices which are available to assist in bead unseating or seating will be helpful; however, sharp objects or forcing of the bead may cause tire damage.

CAUTION: When mounting tires, lock the wheel down securely. Do not exceed 40 psi inflation pressure, when seating tire on the wheel. If 40 psi pressure will not seat beads properly, deflate, lubricate and reinflate tire.

6. Installation of Wheel and Tire Assembly

1. Install wheel mounting nuts in a criss-cross pattern and tighten just enough to seat wheel against hub, to assure proper piloting of wheel on hub.

2. Tighten mounting nuts uniformly to 130 foot-pounds using criss-cross pattern, Fig. 10-5.

CAUTION: These wheel to hub fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each

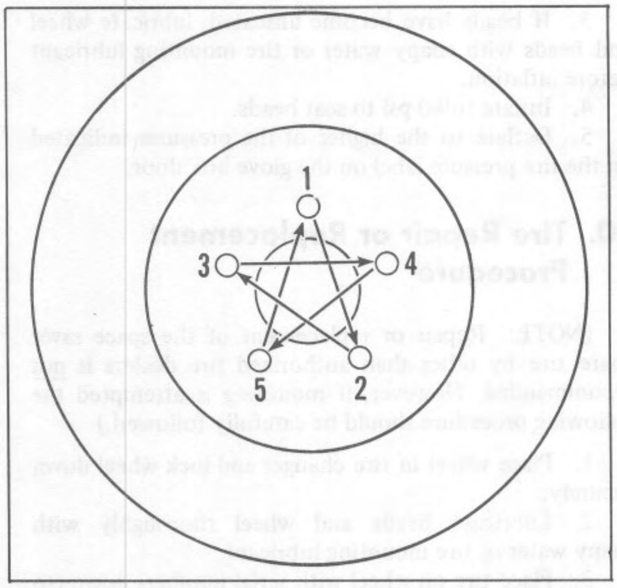


Fig. 10-5 Wheel Mounting Sequence

must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

An impact wrench should not be used as uniform torque control cannot be maintained.

7. Replacement Tires

Replace tire if any of the following conditions are evident.

1. If the tread wear indicator is visible in two or more adjacent grooves.
2. Tire tread or sidewall contains cracks, cuts or snags deep enough to expose the ply cords.
3. Tire has a visible bump, bulge or separation.
4. Tire sustains a puncture, cut or other damage that, because of the damage size and/or location on the tire, cannot be satisfactorily repaired.

When replacing tires, only the size, load range, and construction type (bias, bias-belted, or radial) originally installed on your vehicle are recommended. Use of any other tire size or type tire may seriously affect handling, vehicle ground clearance, and tire clearance to the body and chassis.

Some radial tires are considered as all-weather-type tires and satisfy many customers traction needs in snow belt areas. Steel belted radial tires were designed to provide better snow traction performance than most conventional highway type tires. However, if the situation requires snow treads, use only radial snow tires on radial tire equipped vehicles.

a. Radial Tire Contribution to Steering Pull

Lateral forces developed in some radial tires can contribute to vehicle steering pull. The force results from a property called conicity, which is caused by steel belt positioning beneath the tire tread.

A pull condition (exceeding one lane change in one tenth of a mile at 60 MPH) may be corrected by rotating tires to equalize the individual tire conicity forces.

(NOTE: A cross-car caster differential in excess of alignment specifications in Section 3 will also result in steering pull.)

b. Radial Tire Contribution to Vehicle Waddle

Radial tires with lateral force variation in excess of tire specifications (undetectable by checking tire runout) can result in low speed vehicle oscillation (waddle). The condition will maximize in intensity when offending tires are in phase. The rear wheel positions are most sensitive to tire lateral force variation. The offending tire(s) on vehicles with objectionable waddle should be replaced by the respective tire dealer.

8. Inflation Instructions for Space Saver Spare Tire with Inflator Assembly (Fig. 10-6)

1. Install deflated space saver spare on car with valve stem at the bottom and tighten all five lug nuts.
2. Remove valve cap and make sure valve core is screwed tight in valve stem.

(NOTE: Space Saver Spare Tire wheels are equipped with a safety relief valve. It is part of the valve stem assembly on all except Eldorado, and is a separate unit on the Eldorado wheel. The valve will open to release tire inflation pressure in excess of 50 psi and reseat at 30 psi. If replacement is required use only identical parts.)

3. Remove plastic cap from inflator.

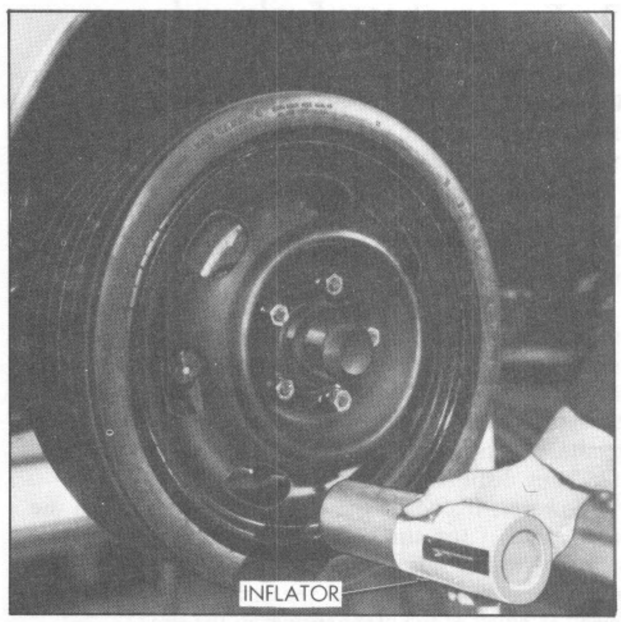


Fig. 10-6 Space Saver Spare

CAUTION: Contains gas under pressure. Keep out of reach of children. Keep hands off metal parts of inflator during inflation as it becomes extremely cold and can cause personal injury.

4. Place inflator over valve stem and push onto stem until sound of gas entering tire can be heard.
5. Keep pressure against valve to prevent leakage of fluid.
6. Hold the inflator in position one minute after sound stops to insure complete draining of fluid, then remove inflator for disposal in proper receptacle.
7. Replace valve cap.

(NOTE: It is recommended that the inflation gas be released and pressure adjusted with air to the higher of the pressures indicated on the tire pressure label on the glove box door as soon as possible after installing tire on car. Remove tire valve stem with tool on valve cap, allowing tire to flatten completely and reinflate with air. The inflator gas is temperature sensitive and may cause a pressure change with continued driving.)

To stow, deflate tire by removing tire valve stem core.

Flatten tire and replace core and cap. Do not inhale gas. Store tire in trunk compartment.

9. Inflation Instructions for Space Saver Spare Tire at a Service Station

1. Mount wheel on car.
2. Inflate to recommended pressure.
3. If beads have become unseated, lubricate wheel and beads with soapy water or tire mounting lubricant before inflation.
4. Inflate to 40 psi to seat beads.
5. Deflate to the higher of the pressures indicated on the tire pressure label on the glove box door.

10. Tire Repair or Replacement Procedure

(NOTE: Repair or replacement of the space saver spare tire by other than authorized tire dealers is not recommended. However, if mounting is attempted the following procedure should be carefully followed.)

1. Place wheel in tire changer and lock wheel down securely.
2. Lubricate beads and wheel thoroughly with soapy water or tire mounting lubricant.
3. Place tire on wheel with serial numbers down (so serial numbers will be on opposite side from valve stem).
4. Work the beads over the rim, being certain that the portion of the bead on the rim is in the deepest rim section to avoid over stretching the beads.

WARNING: OVER STRETCHING THE BEADS MAY DAMAGE TIRE STRENGTH POSSIBLY CAUSING VIOLENT BURSTING OF THE TIRE AWAY FROM THE WHEEL WHICH MAY RESULT IN SERIOUS OR FATAL INJURY.

5. Inflate to 40 psi to seat beads.
6. Deflate to recommended pressure.

TIRE VIBRATION OR ROUGHNESS

11. Tire Roughness Explained

In order for a tire/wheel assembly to cause car vibration, it must first induce a movement in the spindle or axle of the car. The spindle or axle of a car must be moved before the car can "feel" a vibration.

To understand this more completely, think of a "perfectly" round tire as an infinite number of identical "springs", Fig. 10-7. As the tire and wheel rotate, each one of these springs contacts the road and flexes.

If the amount of flexing of each identical spring is uniform as the tire rolls over the smooth road surface, it does not cause the spindle to vary vertically or to be displaced. As long as all the springs have the same stiffness and are rolling on a relatively smooth road, the spindle will not be moved and thus the car will not "feel" any disturbance.

However, if one of these springs is stiffer than the others, and if the tire rotates and comes into contact with the road at this stiffer point, Fig. 10-8, the spindle will deflect upward because the stiffer spring does not "give" as much as the other springs in the tire.

As the tire revolves faster, the frequency of this spindle movement or deflection increases. At a car speed

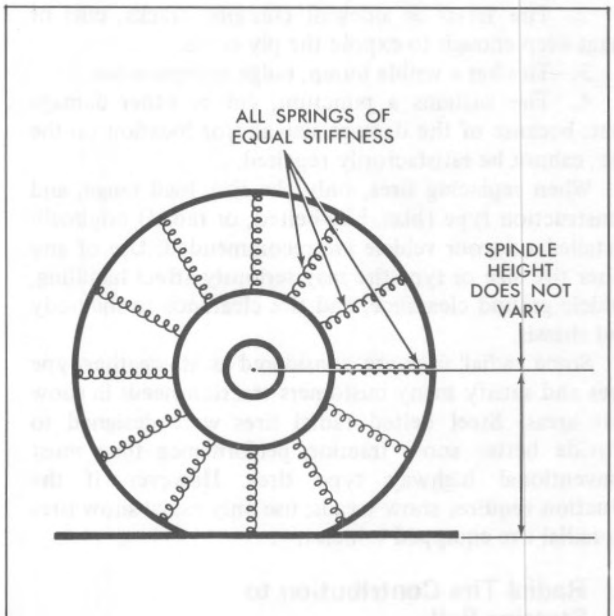


Fig. 10-7 Tire Roughness No. 1

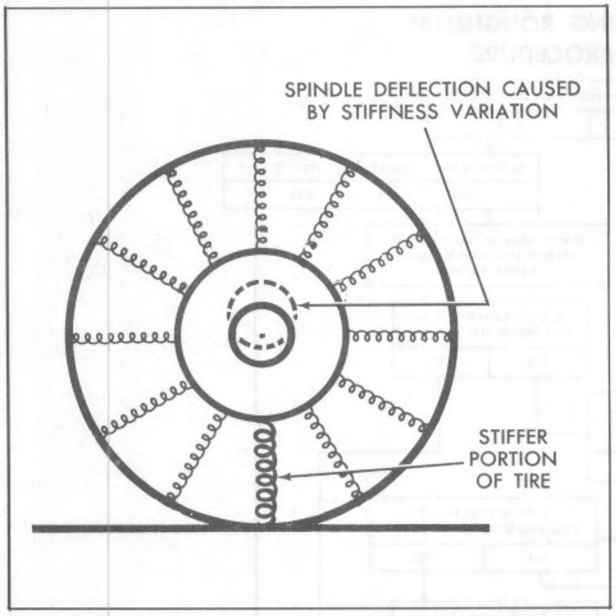


Fig. 10-8 Tire Roughness No. 2

of 60-80 mph, this spindle deflection matches the resonant frequency of most cars suspension system and causes vehicle shake.

12. Radial Forces

The differences in the stiffness of the tire at several points on the tire is called tire "radial force variation" and is a cause of vehicle roughness. The greater the spindle movement (loaded radial runout), the more likely the car is to have a vibration.

Assuming a tire/wheel assembly is balanced correctly, the source of radial force variation is a combination of:

- wheel runout
- tire runout
- construction variables of the tire in a loaded state

(with the weight of the car on the tire)

Because radial force variation is a combination of these three items under a loaded condition, one cannot simply measure each of them to find the tire/wheel assembly causing the vibration. The combined or total loaded force variation must be measured.

TIRE VIBRATION OR ROLLING ROUGHNESS CORRECTION

13. Tire Problem Detector—Preferred

An effective tool for measuring the loaded radial force variation of a tire/wheel assembly is the Tire Problem Detector (TPD), Fig. 10-9. The tires of a car with a vibration complaint are rolled by the TPD at approximately 4 revolutions per minute with the weight of the car loading one tire against a power-driven drum. On most commercially available tire problem detectors, a dial indicator is used to measure the vertical movement of the spindle or axle while the wheel is rolling. One type incorporates graphic means of displaying the frequency and amount of this vertical movement. Another utilizes a roller and dial arrangement. A typical test arrangement is shown in Fig. 10-9.

Extensive testing of the tire problem detector on hundreds of cars with vibration complaints has shown that a spindle movement in excess of .040" will cause a vibration in most vehicles. Replace a tire that results in a tire problem detector reading of .040" or more, or shows a lump(s) – (quick or erratic dial indicator movement from high to low), after all corrective procedures and checking have been completed according to the recommended TPD instructions.

14. Tire Problem Detector (T.P.D.) Instructions

1. Tires must be warmed up to eliminate flat spots and false TPD readings. This can be accomplished by driving car for approximately one-half mile. Car should be raised off of tires as quickly as possible after road test. If this is not practical, tire can be adequately warmed up by allowing TPD to rotate tire for at least five minutes before taking a reading.
2. Raise car on hoist.
3. Remove wheel covers and dust caps.
4. Adjust tires to recommended pressures.
5. When front wheels and tires are being tested, lock steering column with wheels in straight-ahead position with the ignition lock. For rear wheels, put transmission shift lever in Neutral.

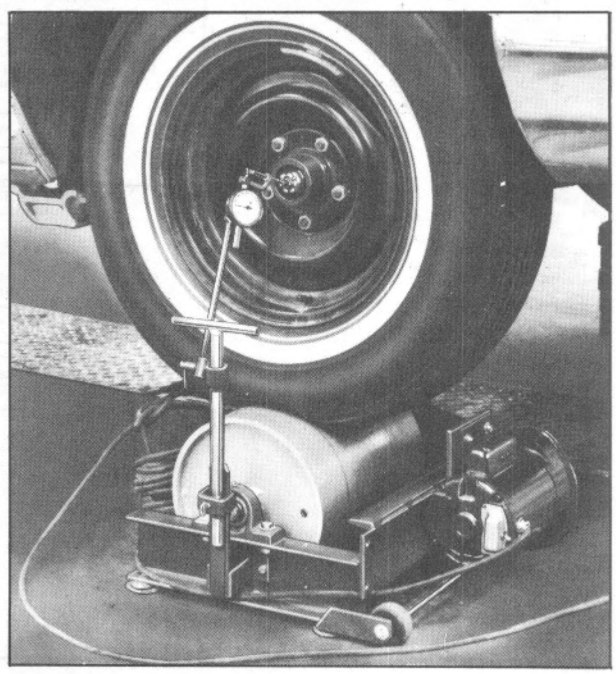


Fig. 10-9 Tire Problem Detector

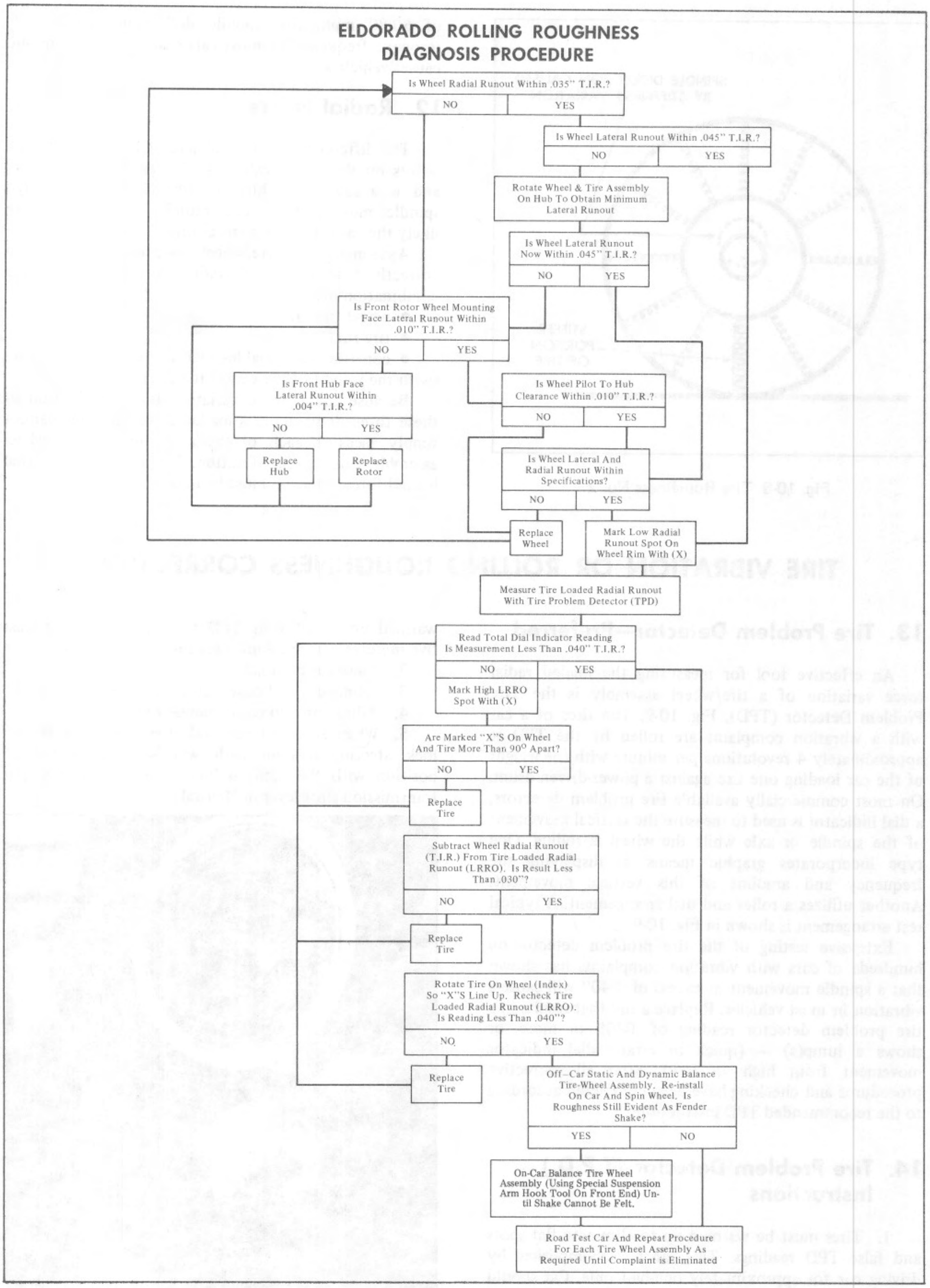


Fig. 10-10 Diagnosis Procedure

On Eldorados, test front tires with transmission shift lever in Neutral and with steering wheel held or braced to prevent movement.

6. Position TPD so that roller is directly under center of tire, fore and aft. Front tire will "walk" sideways on roller if tire is not square with the roller.

7. Place a jack stand or other suitable support under frame on front end or axle housing on rear end on side of car opposite tire to be tested. Adjust height of support so that car will remain approximately level when it is lowered on TPD roller.

8. Start TPD rotating.

(NOTE: TPD roller must be rotating before car is lowered to prevent damage to TPD electric motor.)

9. Lower hoist so that car is resting on the TPD and on the opposite side support.

WARNING: ON CONTROLLED DIFFERENTIAL-EQUIPPED CARS DO NOT ALLOW THE OPPOSITE REAR TIRE ASSEMBLY TO REST ON THE GROUND OR ON A SUPPORT. SINCE THE CAR MAY DRIVE THROUGH THIS WHEEL.

10. Adjust dial indicator so that it reads the up and down motion of wheel spindle using the top of the pilot hole on end of spindle. (Most TPD manufacturers have a dial indicator available as an accessory. However, Kent-Moore tool J-8001 has been found to be the most satisfactory for this purpose.)

When measuring rear tire variation, axle movement can be measured by using the top of the pilot hole in end of axle shaft. On some cars it may be necessary to clean this hole with emery cloth to provide a smooth surface for the dial indicator to run on. Also, the addition of a lubricant on dial indicator pickup surface will help prevent pickup chatter.

11. Record total dial indicator measurement of loaded radial runout. Also mark "X" at the six o'clock or bottom position of tire when dial indicator shows the highest axle position, that is, at its minimum reading. This will mark position on tire of the greatest total loaded radial runout.

12. Raise car so that tire clears roller and measure and record wheel radial runout. Wheel rim should be wiped clean of dirt for accuracy of reading. The tire must be clear of the roller as the wheel may deflect slightly under load and give an incorrect measurement. Mark an "X" on the wheel where radial runout is lowest, that is, where the least wheel radius is indicated. Reading should be taken from inboard side of wheel, Fig. 10-11.

13. Follow diagnostic procedure shown, Fig. 10-10.

If all four tires read less than .040" loaded runout and the car vibration is still objectionable, rotate (index) tires on wheels to obtain the minimum loaded run-out for each. If three or more tires have a reading of .038" or more, remove the spare wheel and tire assembly and substitute it for the tire with the greatest reading. Install the two tires with the lowest readings on the front of the car.

14. It is important to note that balancing the tire and wheel assembly is the last step in the corrective procedure.

Check the factory balance on undisturbed tire/wheel assemblies prior to removing the wheel weights and rebalancing. Factory balance is performed on accurate, expensive equipment and may be better for ride "feel" than can be accomplished on service equipment.

15. Tire Vibration or Roughness

Vibration or roughness problems originating from wheel and tire assemblies may be isolated and corrected by the following optional procedure should tire problem detector equipment not be available:

a. Preliminary Checks

- Check all ties pressures (cold) and inflate or deflate to specification.

IMPORTANT: Tire inflation pressure recommendations are critical for a smooth ride. Raising or lowering tire pressures to "improve" mileage or traction should not be attempted.

- Remove all foreign material from tire treads and wheels.
- Road test car with owner to establish specific ride disturbance.
- Proceed to Part b to isolate offending wheel and tire assembly.

b. Wheel Spinning

By spinning each wheel in succession, offending tire may be isolated by vibration that may be felt through nearest bumper or fender.

Commercially available wheel spinners can be used on C-car front wheels or Eldorado rear wheels.

If wheels will not spin at balancing speed, push caliper housing outboard to free disc from linings.

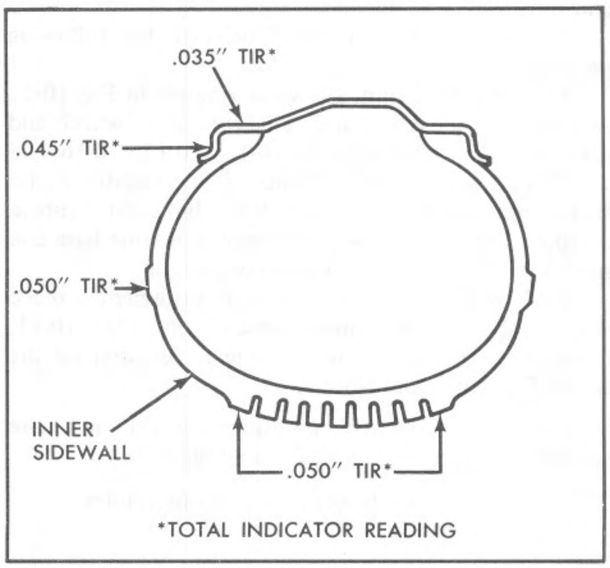


Fig. 10-11 Wheel And Tire Runout Guide

If car is equipped with Controlled Differential, it may be advisable to remove one rear wheel while testing the other. Before removing a wheel, place a chalk mark on a stud and its corresponding lug bolt hole for proper orientation on assembly. Be sure to replace wheel mounting nuts on any rear hub being spun with the wheel assembly removed. This is necessary to assure proper retention of brake drum. If nuts are not threaded all the way, spacers should be installed under nuts.

WARNING: WHEN BALANCING TIRES ON THE CAR, FOLLOW THE EQUIPMENT MANUFACTURER'S INSTRUCTIONS CAREFULLY. ON CARS WHICH DO NOT HAVE CONTROLLED DIFFERENTIAL, DRIVE WHEEL SPIN SHOULD BE LIMITED TO 35 MPH (52 MPH ON ELDORADO) AS INDICATED ON THE SPEEDOMETER. THIS LIMIT IS NECESSARY BECAUSE THE SPEEDOMETER ONLY INDICATES ONE-HALF OF THE ACTUAL WHEEL SPEED WHEN ONE DRIVE WHEEL IS SPINNING AND THE OTHER DRIVE WHEEL IS STOPPED. UNLESS CARE IS TAKEN IN LIMITING DRIVE WHEEL SPIN, THE SPINNING WHEEL CAN REACH EXCESSIVE SPEEDS, RESULTING IN POSSIBLE TIRE DISINTEGRATION OR DIFFERENTIAL FAILURE, WHICH COULD CAUSE PERSONAL INJURY OR EXTENSIVE VEHICLE DAMAGE.

ON CARS WHICH DO HAVE CONTROLLED DIFFERENTIAL, DRIVE WHEEL SPIN SHOULD BE LIMITED TO 70 MPH. ON SUCH CARS, DO NOT ATTEMPT TO BALANCE A DRIVE WHEEL WITH THE OTHER DRIVE WHEEL ON THE GROUND SINCE THE CAR MAY DRIVE THROUGH THIS WHEEL.

c. Correcting Excessive Runout

Vibrations not isolated by wheel spinning or balancing are often due to excessive runout of wheel and/or tire.

To correct this condition, perform the following procedures:

1. Using maximum allowable runouts in Fig. 10-11 as a guide, check lateral and radial runouts of wheels and tires as Figs. 10-12, 10-13, 10-14, 10-15, 10-16 and 10-17. Use Dial Indicator, J-8001, Dial Indicator Roller Extension, J-23672-1, and Dial Indicator Thread Adapter, J-23672-2. Use a magnetic mounting base and mount dial indicator assembly to suspension.
2. If any of the four runout measurements exceed the corresponding measurements in Fig. 10-11, reposition tire 180° from its original location on the wheel, Fig. 10-18 and Note 5.

(NOTE: Do not reposition wheel and tire assemblies that do not exceed runout guide.)

3. Balance repositioned (indexed) assemblies.
4. Road test car.

d. Rotor Face Runout

1. Remove front wheel and tire assembly.

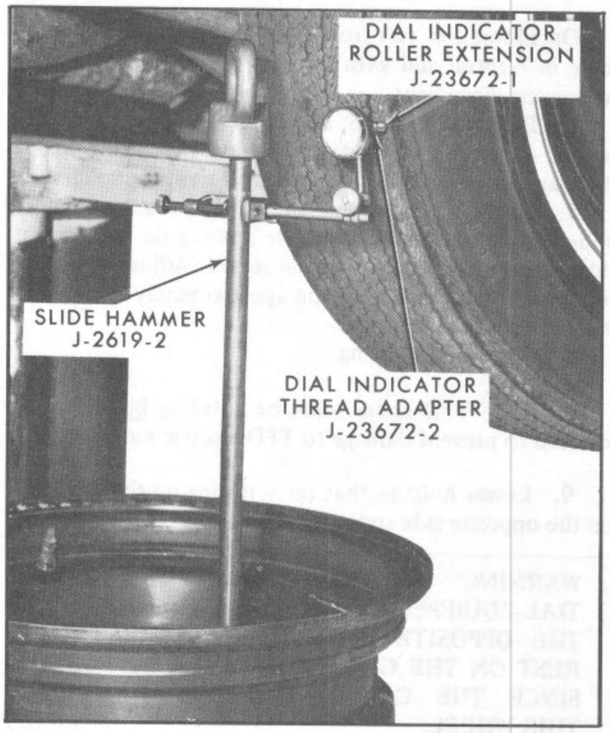


Fig. 10-12 Checking Radial Runout Of Tire

2. Install three reversed wheel mounting nuts to hold brake rotor securely in place. Fig. 10-16.
3. Set-up dial indicator as shown in Fig. 10-16 and take dial indicator reading of rotor face while turning brake rotor by hand. Reading should not vary more than .010".

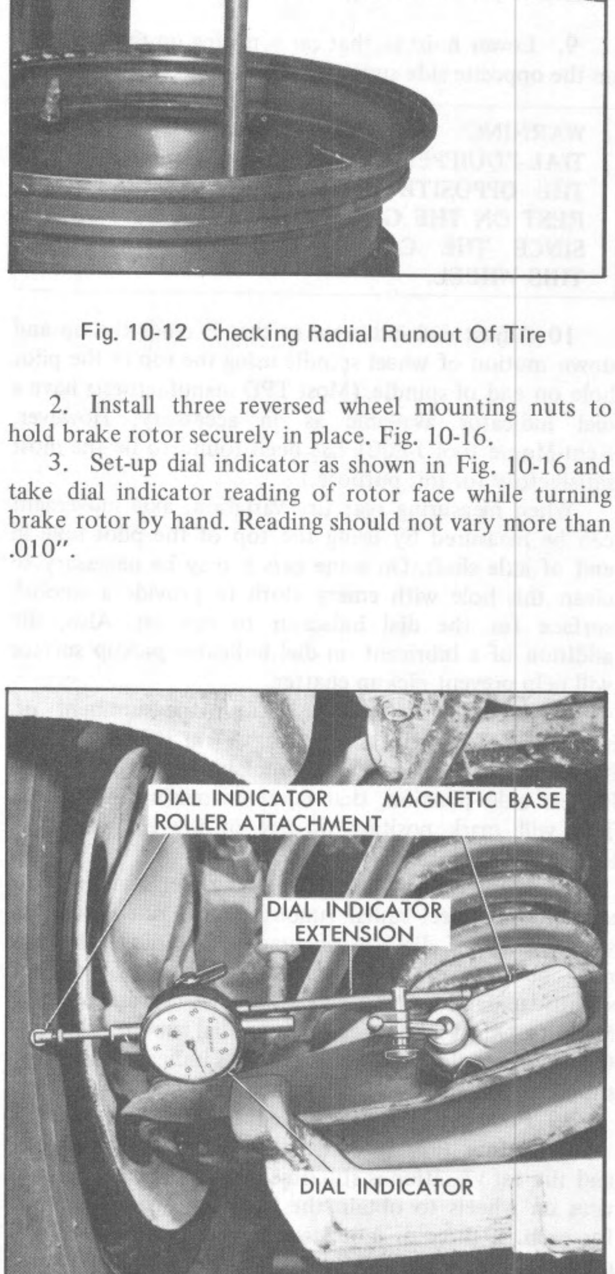


Fig. 10-13 Checking Lateral Runout Of Tire

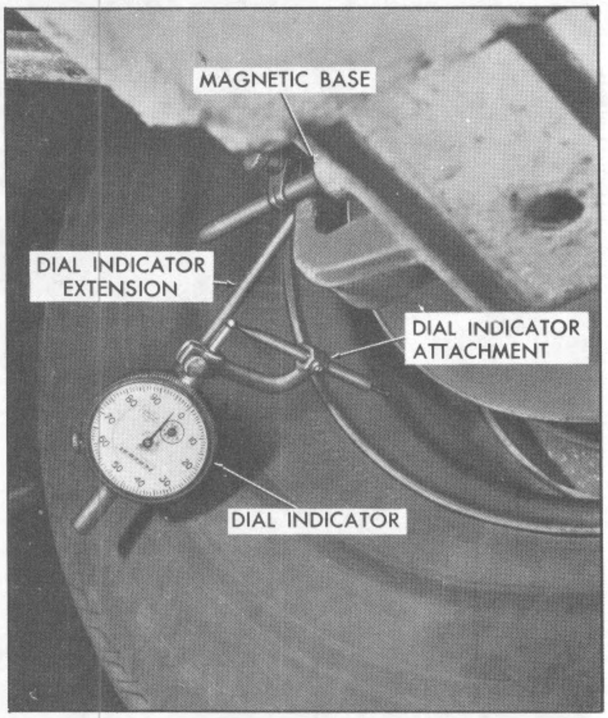


Fig. 10-14 Checking Radial Runout Of Wheel

(NOTE: Mount dial indicator with stem at right angles to wheel mounting surface of rotor and point of contact just outside the bolt circle.)

4. If indicator reading exceeds the .010" variance, check the hub flange behind it, Note 15e. If not, re-index wheel to obtain minimum radial runout at the

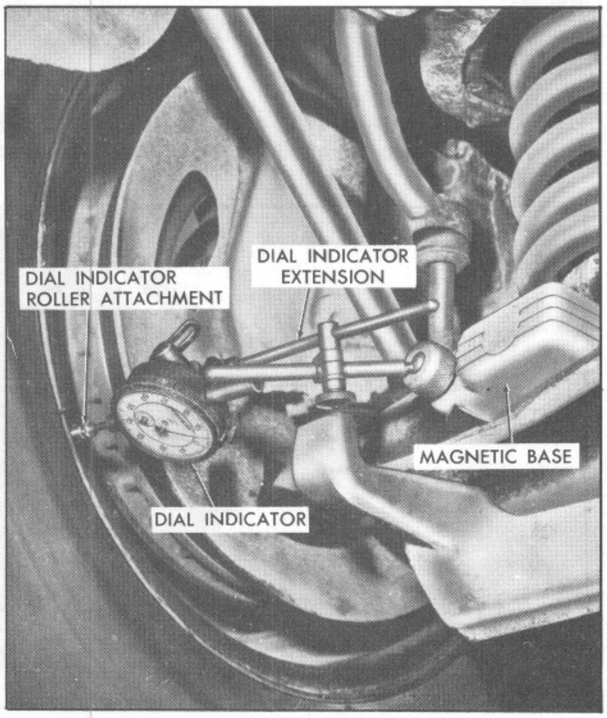


Fig. 10-15 Checking Lateral Runout Of Wheel

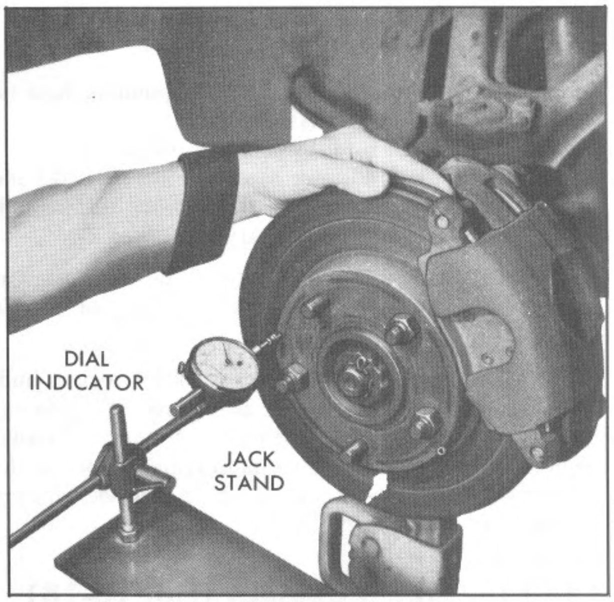


Fig. 10-16 Checking Rotor Face Runout

inner rim, mark its position and rebalance wheel and tire assembly as outlined in Note 16.

e. Hub Flange Runout

With tire and wheel removed as outlined in Note 15d,

1. Remove three nuts used to secure brake rotor.
2. Remove cotter pin and nut on upper spherical joint.
3. Remove brake hose clip from spherical joint stud.
4. Remove two bolts securing brake caliper to steering knuckle and slide caliper off disc. Use a piece of wire to attach caliper to frame.

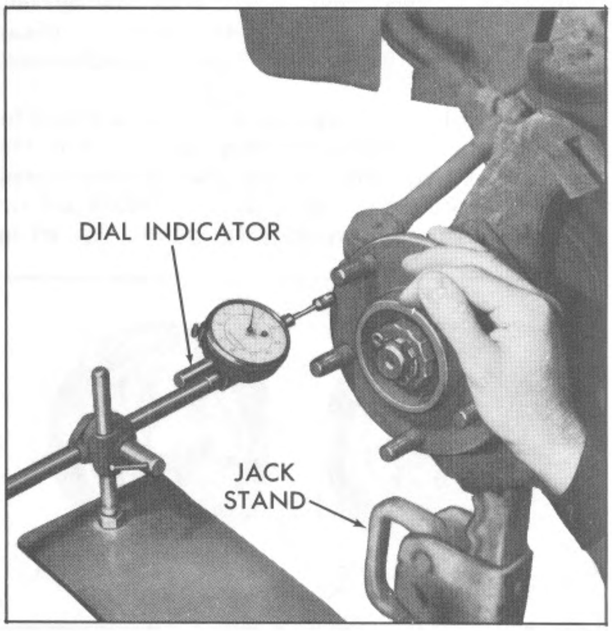


Fig. 10-17 Checking Hub Flange Runout

CAUTION: Do not allow caliper to hang from brake line.

5. Make a wheel stud and a corresponding place on the rotor to assist in installation.
6. Remove the rotor by sliding it off the hub.
7. Set up dial indicator as shown in Fig. 10-17 and take indicator reading of hub flange while turning hub by hand. Indicator should not vary more than .004".

(NOTE: Mount dial indicator with stem at right angles to flange face and point of contact just outside the bolt circle.)

8. If indicator reading exceeds .004", replace hub; if not, re-index or replace rotor as required to obtain less than .010" face runout as outlined in Note 15d. Finally, re-index wheel to obtain minimum radial runout at the inner rim, mark its position and rebalance wheel and tire assembly as outlined in Note 16.

16. Tire/Wheel Balance (Fig. 10-18)

Tire/Wheel balance has traditionally been a major cause of vehicle vibration. In cases of imbalance, a vibration can be reduced to an acceptable level by performing a careful static and dynamic wheel balance.

(NOTE: Do not rebalance a tire/wheel assembly that checks within 1/2 oz. static balance except Eldorado or within 1 oz. static and 1 oz. dynamic balance on the Eldorado.)

Recommended Balance Method

Off the car static and dynamic balance is recommended to maximize balance accuracy. Rotation without rebalance can be performed with this method without balance degradation.

Use commercially available wheel balancing equipment to check and correct static and dynamic balance of offending wheel and tire assemblies off-car, after correcting for runout. Follow manufacturer's instructions.

On-car balance if roughness still exists to correct for imbalance in other rotating components – Mark "on car" balance weights for removal when tires are rotated. "On car" balancing of Eldorado front wheel and tire assemblies require heavy duty equipment. Use set up

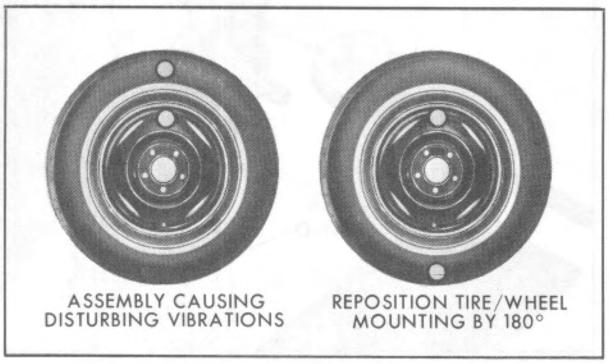


Fig. 10-18 Repositioning Tire On Wheel

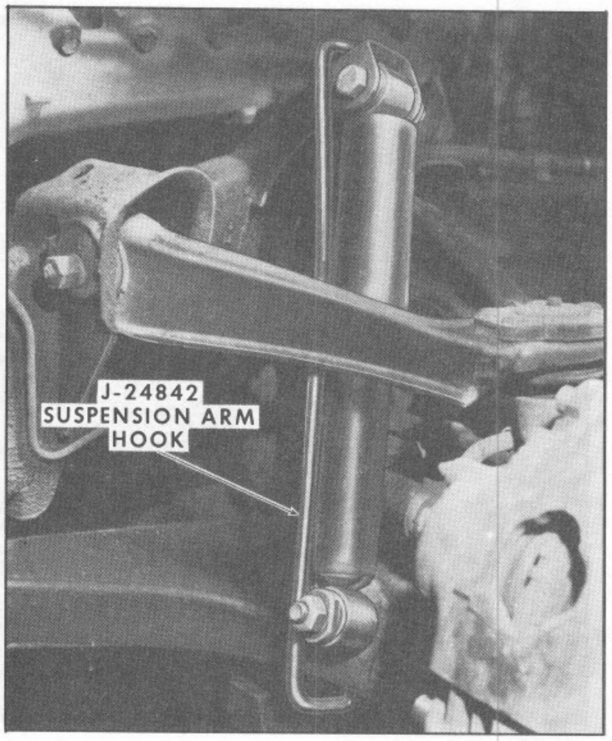


Fig. 10-19 Suspension Arm Hook

described in Figure 10-19 to keep suspension at normal standing height to avoid excitements from angulated joints in drive axles.

Suspension arm hook J-24842 must be installed on the Eldorado front suspension before balancing is attempted.

Fig. 10-19 shows the hook in the installed, on car position. The installation and removal procedures are as follows:

a. Installation

1. Open hood.
2. Reaching over fender position hook through upper control arm inboard of front shock absorber,

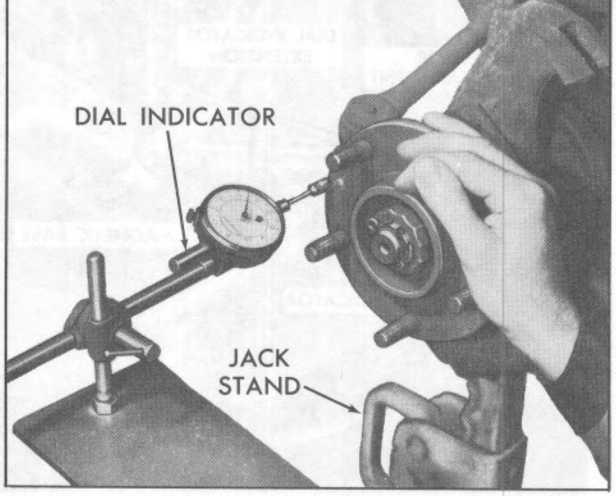


Fig. 10-20 Static And Dynamic Unbalance

engaging lower end of hook into hole in lower control arm (as shown) below shock absorber lower mount.

3. Using your body weight on fender, engage top of hook in hole in top of upper shock absorber mount.

b. Removal

1. Using your body on fender, disengage top of hook from upper shock absorber mounting bracket hole.

2. Working hook downward, disengage hook at lower control arm and remove hook.

3. Close hood.

Worn Tire Induced Vehicle Roughness

Non-uniform tire wear, including cupping and flat spotting, induce inputs to the vehicle.

The source of non-uniform wear can be excessive mileage in one wheel position (front except Eldorado and rear on Eldorado) due to omission of recommended rotation as excessive toe-in or toe-out.

Correction of uneven tread wear can be accomplished with some success if the condition is detected early by:

- Grinding tires on cars with commercially available equipment.
- Rotating tires with uneven wear to the driven wheel positions (rear except Eldorado and front of Eldorado cars).

Other Causes of Vehicle Roughness

See General Information, Maintenance and Lubrication Section 0, Page 0-15.

SPECIAL TOOLS

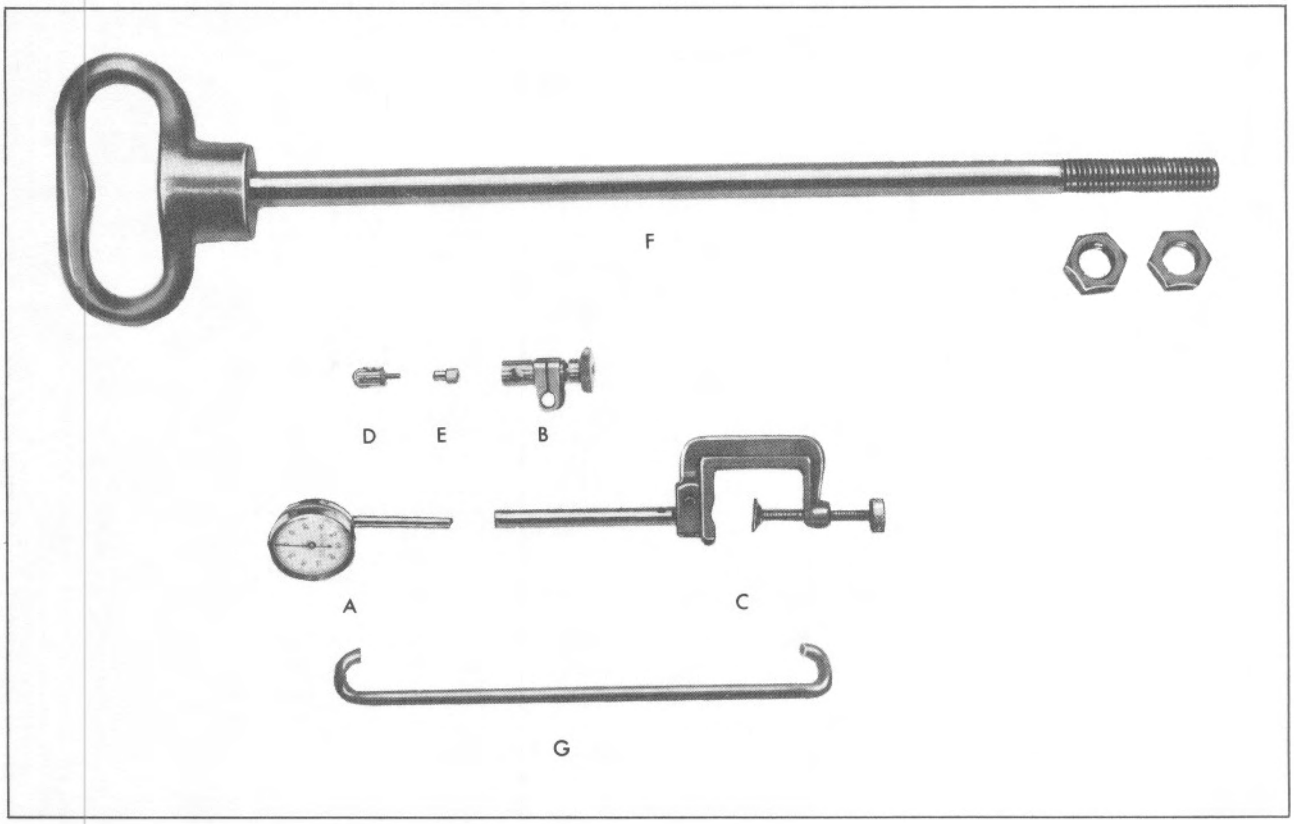


Fig. 10-21 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8001-3	Dial Indicator	E	J-23672-2	Dial Indicator Thread Adapter
B	J-8001-2	Sleeve	F	J-2619-2	Slide Hammer
C	J-8001-1	Clamp	G	J-24842	Suspension Arm Hook (Eldorado)
D	J-23672-1	Dial Indicator Roller Extension			

GENERAL DESCRIPTION

The chassis sheet metal described in this section consists of the following items: hood, front fenders, and wheelhousings.

The hood is hinged near the cowl and opens from the front. The hood primary lock is located in the center of the hood lock tie bar on the radiator cradle.

The hood is unlocked by pulling on the hood lock release handle that is located on the left kick panel just below the headlight switch, Fig. 11-1. The hood secondary latch release lever, Fig. 11-2, is accessible between the grille and hood panel after the primary lock has been actuated. Upward pressure on the hood latch secondary lever, Fig. 11-2, permits the hood to be raised.

Fig. 11-1 Hood Lock Release Handle

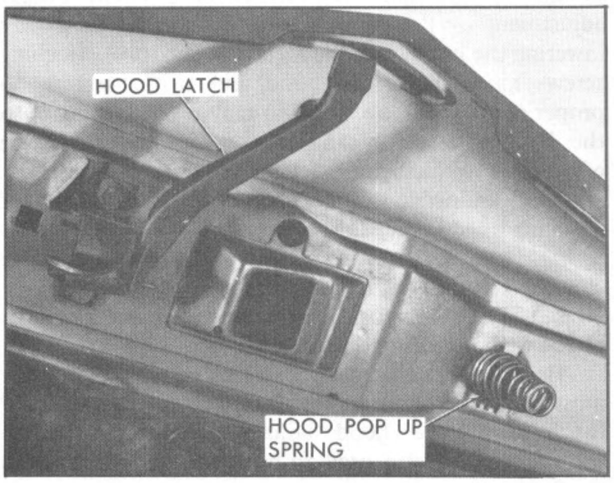


Fig. 11-2 Hood Release Lever

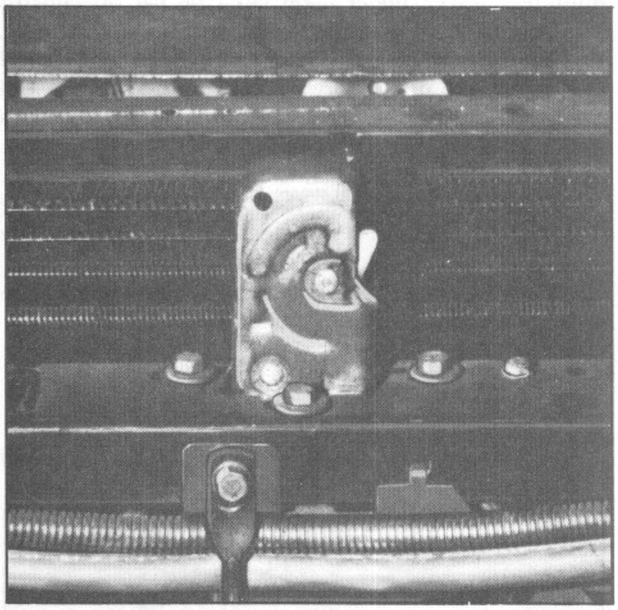


Fig. 11-3 Hood Primary Lock

SERVICE INFORMATION

1. Hood Latch Mechanism Adjustment

The hood latch assembly consists of a hood primary lock, Fig. 11-3, attached to the radiator cradle tie bar in the center by three screws and a hood secondary latch release lever attached to the hood inner panel by two screws. Tighten primary latch screws and secondary latch screws to 18 foot-pounds.

CAUTION: These hood latch assembly fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with equivalent parts if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

The striker plate in the hood panel is large enough to take care of any fore and aft adjustment necessary. Cross car adjustment only is provided at the hood lock mounting. Up and down adjustment is provided in the lock itself which has an automatic take up latch.

When the hood latch assembly has been removed,

the mounting screws loosened, or the hood adjustment changed, make certain that proper alignment has been obtained before tightening the mounting screws. Proper adjustment of the primary lock is achieved by slowly lowering the hood onto the lock with the three attaching screws loose. Raise the hood and tighten screws to proper torque. Failure to do so may result in damage to the latching assembly and/or excessive release handle efforts due to misalignment when the hood is closed.

The following procedure is recommended for checking hood latch adjustments:

a. Drop hood from a height of 6 to 8 inches above closed position. The latch must engage.

b. The latch must release when release handle is pulled without lifting the hood.

Hood latches that do not engage or release properly must be corrected by proper adjustment of the hood latch and the hood adjustable bumpers. These adjustments are also used to bring the hood flush with the fenders.

c. Lower hood slowly until the striker plate rests on the latch. With hood in this position, secondary latch must be engaged under hood latch tie bar on radiator cradle, and must have a clearance of .10" sideways. maximum between latch hook and tie bar. A vertical pull up at one of the forward corners of the hood will indicate that proper secondary installation has been performed, in that the hood will be restricted from opening beyond the hook of the secondary latch.

Secondary latches that do not meet these requirements must be adjusted by repositioning the secondary latch on the hood assembly.

d. Both primary and secondary latches must be free of excess friction or binding when operated.

2. Hood Panel

a. Removal (Fig. 11-4)

1. Scribe hinge locations on underside of hood panel to aid in repositioning the hood when it is reinstalled.

2. Remove six screws and washers, three each side, retaining hinge assemblies to hood panel.

3. Remove hood with the aid of a helper, using care to avoid damaging finish.

CAUTION: When hood is removed from car, never stand it upright on rear corners nose up. Hood must be positioned so that it rests on its side; otherwise, damage to sheet metal may result.

Fig. 11-4 Hood Hinge

b. Installation (Fig. 11-4)

(NOTE: Install an exhaust manifold stud in center holes of hood retaining plate to help locate and position adjusting screws when installing hood.)

1. With the aid of a helper, place hood in position on hood hinge assemblies and loosely install three screws and washers at each hinge assembly.

2. Position hood so that hinges line up with scribe marks and tighten screws at each hinge to 30 foot-pounds.

3. Carefully close hood and check alignment of hood at fender and grille opening.

4. Align hood, if necessary, as described in Note 3.

5. Adjust hood latch mechanism as described in Note 1.

3. Hood Adjustment

1. Loosen hood attaching screws, three at each hood hinge, fig. 11-4. Elongated holes in hinge provide fore, aft, and side adjustment of hood. Position hood so that tolerances shown in Fig. 11-7 (Fig. 11-8 on Eldorados) are provided.

2. Tighten hinge to hood attaching screws on both sides to 30 foot-pounds.

3. Adjust rubber bumpers, located on the tie bar, one each side, so that hood panel is flush with fenders at this point.

4. Adjust hood latch mechanism as described in Note 1.

4. Hood Hinge Spring

a. Removal (Fig. 11-4)

1. Open Hood and prop as high as possible.

2. Using a strong wire hook, attach one end to center of pry bar of sufficient length and the other end to hinge spring.

3. With the aid of a helper, lift pry bar until spring disengages from hood hinge, then release pressure on bar slowly until spring is loose, then unhook other end of spring from hinge.

b. Installation (Fig. 11-4)

1. Hook one end of spring on hinge, then with the aid of a helper, use pry bar and wire hook to connect spring to front of hinge.

2. Remove prop and close hood.

5. Front Fender (Right or Left)

a. Removal (Fig. 11-5)

1. If left fender is to be removed, disconnect negative battery cable. If right front fender is to be removed, remove the battery and the power antenna (Section 15, Note 12 a).

Note number of shims at each attaching, so that same number are installed during installation.

2. Apply masking tape to rear edge of fender to avoid scratching finish when removing fender.
3. Raise front end of car and remove wheel on side of car from which fender is being removed.
4. Remove one screw and shims retaining fender to door at lower hinge pillar.
5. Remove one screw and shims that hold rear bottom of fender to rocker panel.
6. Remove four fender attaching screws from wheel opening edge of wheelhousing.
7. Remove two screws from inside top of wheelhousing.
8. Remove one screw from each of two angle brackets securing radiator cradle to fender.
9. Disconnect cornering light and position the wiring harness out of way.
10. Remove two screws securing cornering light to fender and remove light.
11. Remove one screw and shims that hold fender to cowl.

(NOTE: When removing left front fender, disconnect underhood wiring harness from retaining straps on fender reinforcement.)

12. Remove fender by lifting outward and slightly forward.

b. Installation (Fig. 11-5)

All fender attaching bolts should be loosely installed until fender alignment is obtained. Install the same number of shims at each location as were removed. Then tighten to proper torque specification. Loosen wheelhousing attaching screws if necessary to align fender properly.

1. Position fender in approximate location, being careful not to damage leading edge of door or trailing edge of fender.
2. Install one screw and shims at top rear of fender.
3. Install two screws with washers attached to wheelhousing at top of wheel opening.

(NOTE: When installing left fender, make sure wiring harness and hood release cable are routed between fender and wheelhousing.)

4. Install four screws at wheel opening edge of fender securing fender to wheelhousing.
5. Install one screw and shims that hold rear bottom of fender to rocker panel.
6. Install one screw and shims that hold fender to cowl.
7. Secure each of two angle brackets on radiator cradle to fender with screw and U-nut.
8. Install two screws that secure cornering light to fender.
9. Position wiring harness and connect cornering light.
10. If working on left front fender position underhood wiring harness to fender reinforcement and secure with retaining straps.
11. Obtain proper alignment of fender as shown in Fig. 11-7, and tighten all screws installed in Steps 2 through 8 to proper torque as shown in chart on Page 11-7.
12. Install or connect battery as required.
13. Install wheel and lower car to floor.
14. Install power antenna as described in Section 15, Note 12b.

6. Front Fender Wheelhousing (Right or Left)

a. Removal

1. Remove front fender as described in Note 5a.
2. If working on left side, remove horn from wheelhousing. When removing right wheelhousing, proceed as follows:
   a. Remove Automatic Level Control compressor as described in Section 4, Note 21a.
   b. Remove heater and air conditioner hoses from wheelhousing.
   c. Remove battery cable from retaining straps.
   d. Remove power antenna as in Section 15, Note 12a.
3. Remove one screw, washer, and tapping plate securing wheelhousing splash shield to bumper outer end.
4. Remove three screws and washers securing wheelhousing splash shield to frame.
5. Remove three screws with washers attached at rear of wheelhousing that secure brace to wheelhousing.
6. Remove two screws with washers attached and tapping plate from angle bracket securing hood hinge to wheelhousing.
7. Remove two nuts and washers that secure cowl-to-wheelhousing strut and wheelhousing-to-radiator cover strut to top of wheelhousing. Swing struts out of way.
8. Remove two screws and tapping plate from brace that secures the front of wheelhousing to cradle.
9. Remove two screws and tapping plates at front of wheelhousing that secure wheelhousing bracket on radiator cradle mount.
10. Remove wheelhousing.

b. Installation

1. Position wheelhousing in approximate location and loosely install three screws at rear of wheelhousing that secure rear brace to wheelhousing.
2. Loosely install two screws and tapping plate from angle bracket that secure hood hinge to wheelhousing.
3. Loosely install two screws and tapping plates securing front of wheelhousing to bracket at radiator cradle mount.
4. Install two screws and tapping plates securing wheelhousing to front brace.

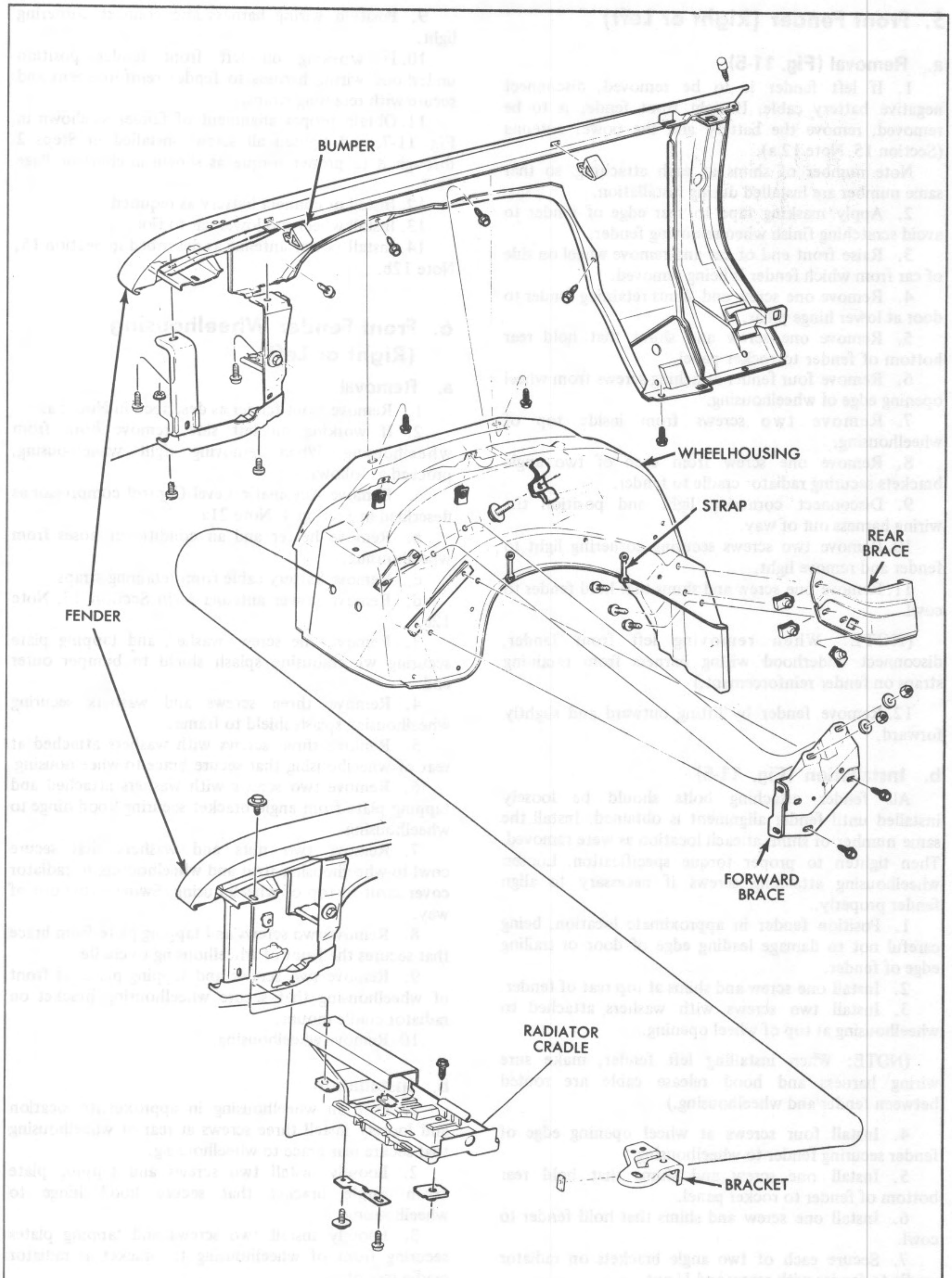


Fig. 11-5 Front Fender Disassembled (Except Eldorado)

5. Loosely install two nuts and washers on cowl-to-wheelhousing strut. Secure wheelhousing-to-radiator cover strut with one of three nuts.

6. Install one screw, washer, and tapping plate securing wheelhousing splash shield to bumper outer end.

7. If right wheelhousing is being installed, proceed as follows:

a. Install Automatic Level Control compressor as described in Section 4.

b. Position and secure heater and air conditioning hoses to wheelhousing.

c. Secure negative battery cable to wheelhousing with two straps.

d. Install power antenna.

8. Install three screws and washers securing wheelhousing splash shield to frame.

9. Check alignment of wheelhousing and tighten all attaching nuts, bolts, and screws.

10. If working on left side, install horn.

11. Install front fender as described in Note 5b.

7. Front Fender (Right or Left)—Eldorado

a. Removal (Fig. 11-6)

1. If left fender is to be removed, disconnect negative battery cable. If right fender is to be removed, remove battery, power antenna and automatic level control compressor.

Note number of shims at each attachment so that same number are installed during installation.

2. Apply masking tape to rear edge of fender to avoid scratching finish when removing fender.

3. Raise front of car and remove wheel at fender being replaced.

(NOTE: When removing left front fender, disconnect forward lamp harness from retaining straps on fender reinforcement.)

4. Disconnect wiring connector for parking, turn signal, cornering and side marker lamps. Also remove monitor conductors from headlamp connectors.

5. Open door and remove one screw and shims securing lower rear edge of fender inside door opening.

6. Remove seven screws securing rocker panel molding to body and remove molding.

7. Remove one screw, washers and shims securing bottom rear edge of fender to rocker panel.

8. Remove one screw and washer securing lower rear corner of wheelhousing to rocker panel.

9. Remove one screw, washer and shims securing top rear of fender to cowl under hood.

10. Remove one screw and tapping plate securing fender to angle bracket on radiator cradle.

11. Remove one bolt and U-nut securing front lower corner of fender to radiator cradle strut rod.

12. Remove six screws securing fender to bottom of wheelhousing.

13. Remove one screw from front wheelhousing splash shield to fender.

14. Remove two screws securing fender to top of wheelhousing.

15. Remove front fender.

b. Installation

1. Position fender on car and loosely install two screws securing fender to top of wheelhousing.

(NOTE: When installing left fender make sure wiring harness and hood release cable are routed between fender and wheelhousing.)

2. Loosely install two screws securing fender to top of wheelhousing.

3. Loosely install one screw securing front wheelhousing splash shield to fender.

4. Loosely install six screws securing fender to bottom of wheelhousing.

5. Loosely install one bolt and U-nut securing front lower corner of fender to radiator cradle strut rod.

6. Loosely install one screw and tapping plate securing fender to angle bracket on radiator cradle.

7. Loosely install one screw, washer and shims securing top rear of fender to cowl under hood.

8. Loosely install one screw and washer securing lower rear corner of wheelhousing to rocker panel.

9. Loosely install one screw and shims securing lower rear edge of fender inside door opening.

10. Check alignment and tighten all screws to proper torque.

11. Position rocker panel molding to body and secure with seven screws.

12. Position and connect wiring connector for parking, turn signal, cornering and side marker lamps. Also monitor conductors into headlamp connectors.

(NOTE: If installing left front fender, connect underhood wiring harness to retaining straps on fender reinforcement.)

13. With front end of car still raised, install wheel previously removed.

14. Remove masking tape from rear edge of fender.

15. If left fender was removed install negative battery cable. If right fender was removed, install battery, automatic level control compressor and power antenna.

8. Front Fender Wheelhousing Right or Left—Eldorado

a. Removal

1. Remove fender as described in Note 7a.

2. Remove two screws and tapping plate securing hood hinge angle bracket to wheelhousing.

3. If working on left side, remove horn from wheelhousing. If removing right wheelhousing, remove heater and A/C hoses from clip on wheelhousing and support and position hoses out of way.

4. Remove two screws and U-nuts securing forward portion of wheelhousing to bracket on radiator cradle.

5. Remove two screws and one tapping plate securing forward wheelhousing brace to radiator cradle.

6. Remove one screw from rear wheelhousing splash shield to frame.

7. Remove wheelhousing from car.

b. Installation

1. Position wheelhousing in approximate location.

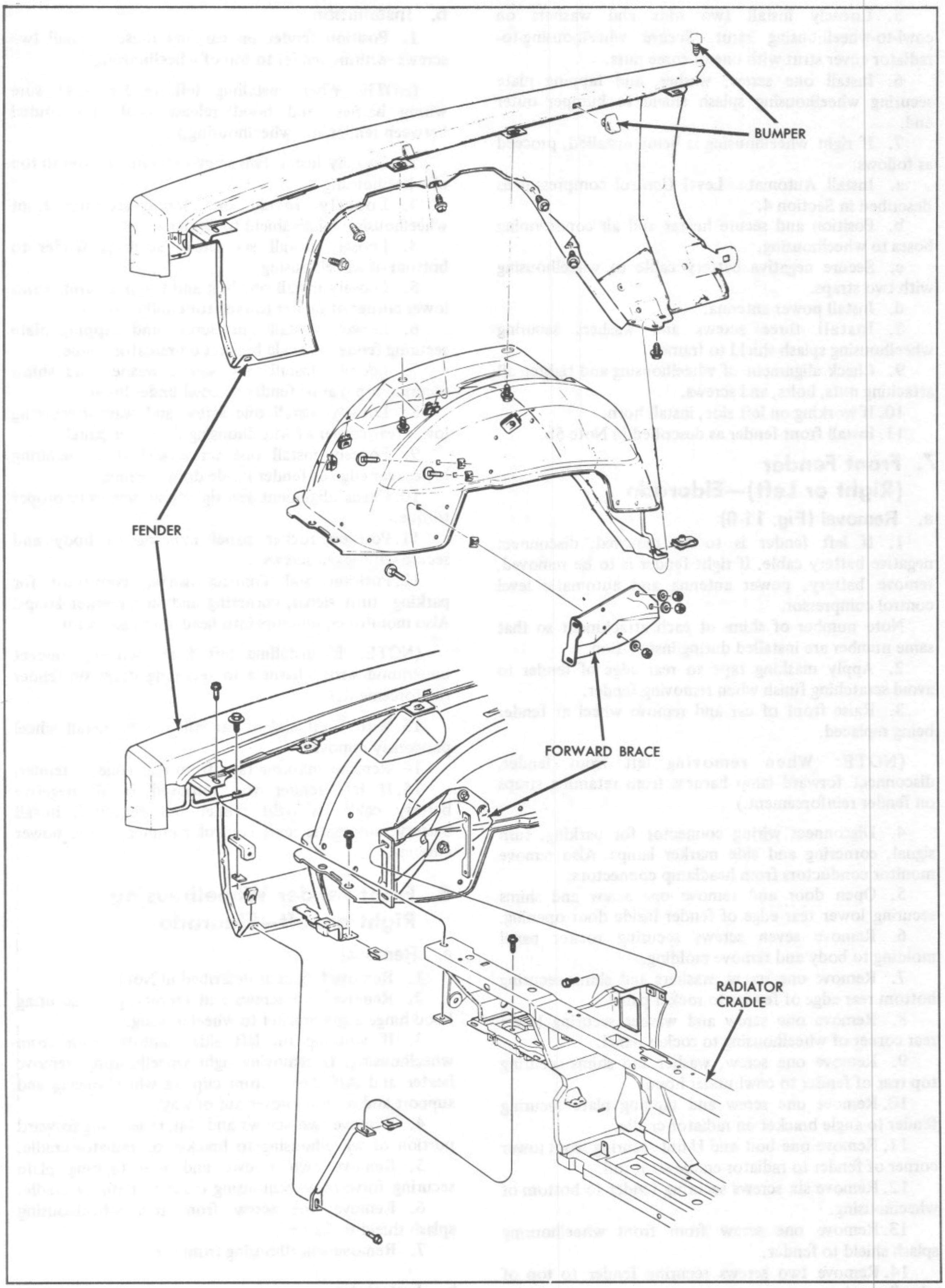


Fig. 11-6 Front Fender Disassembled—Eldorado

2. Loosely install one screw securing rear wheelhousing splash shield to frame.

3. Loosely install two screws and one tapping plate securing forward wheelhousing brace to radiator cradle.

4. Loosely install two screws and tapping plates securing forward portion of wheelhousing to bracket on radiator cradle.

5. If working on left side, position horn to wheelhousing and secure with fastener. If installing right wheelhousing, position heater and air conditioning hoses beneath clip on side of wheelhousing.

6. Loosely install two screws and tapping plate securing hood hinge angle bracket to wheelhousing.

7. Install fender as described in Note 7b.

9. Adjusting Sheet Metal Tolerances

a. Front Fender

1. Loosen all screws at the following locations:

a. Fender reinforcement to radiator cradle bracket.

b. Cowl

c. Front hinge pillar.

d. Rocker panel extension to underside of fender.

e. Fender to wheelhousing inside of wheel opening.

2. Remove rubber bumpers that fit between fender and hood.

3. Adjust fender so that clearances are as shown at points #2, #5, #12 and #13, Fig. 11-7.

4. After obtaining adjustment, tighten all screws to proper torque specifications as shown at the end of this section.

5. Install rubber bumpers that fit between fender and hood.

b. All Body Clearances

The adjustment procedures for clearances #1 through #13 (except #2, #5, #12, #13 and #14 in Fig. 11-6) are described in the body service manual. These clearances should be adjusted to the specifications shown in Fig. 11-7.

10. Adjusting Sheet Metal Tolerances (Eldorado Only)

The adjustment procedures for clearances #1 through #11 (except #3, #4, #5, #11 and #12 in Fig. 11-8) will be found in the body service manual.

Clearances #3, #4, #5 and #11 should be adjusted by the procedures as outlined in Note 9a.

These clearances should be adjusted to the specifications shown in Fig. 11-8.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
275M	Hood Hinge to Hood	3/8-16	30
275M	Hood Hinge to Cowl	3/8-16	25
275M	Secondary Latch to Hood	5/16-18	*18
275M	Primary Latch to Tie Bar	5/16-18	*18
275M	Front Fender to Radiator Cradle	5/16-18	18
275M	Front Fender to Cowl	3/8-16	25
275M	Front Fender to Rocker Panel	3/8-16	25
275M	Front Fender to Hinge Pillar	3/8-16	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			

CAUTION: These hood latch assembly fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with equivalent parts if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

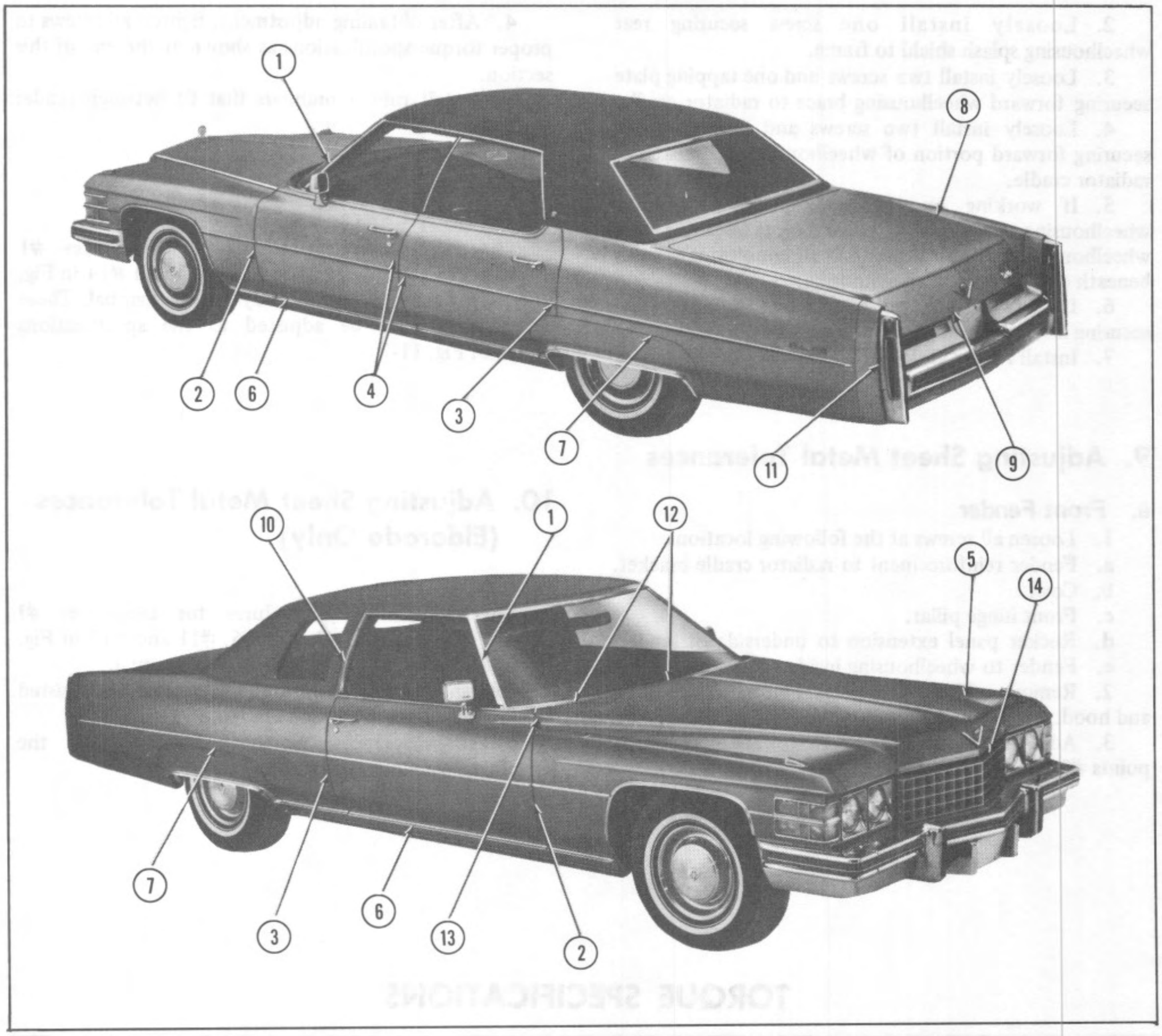


Fig. 11-7 Sheet Metal Tolerances (Except Eldorado)

SHEET METAL TOLERANCES (EXCEPT ELDORADO)

Location	Style	Clearance Gap"	Flushness
1. Side window to windshield	All except	3/8-7/16	—
	23 and 33	1/8-1/4	—
2. Door to Fender	All	7/32-9/32	3/32 +.00
3. Door to Quarter Panel	All	1/8-1/4	+0-1/16
4. Front Door to Rear Door	All	1/8-1/4	+0-1/16
5. Hood to Fender	All	3/32-5/32	±1/16
6. Door to Rocker Panel	All	1/8-1/4	—
7. Wheel Skirt to Quarter Panel	All	1/8-1/4	±1/16
8. Trunk Lid to Fender	All	1/16-1/4	±1/16
9. Trunk Lid to Bumper	All	1/2-3/4	—
10. Windows	49, 47 & 67 only	5/16-3/8	*
11. Bumper to Quarter Panel	All	1-23/32-1-31/32	
12. Hood to Windshield Wiper Arm	All	1/2 Min.	—
13. Hood to Door	All	7/32-9/32	±1/16
14. Hood to Grille	All	7/16-13/16	

*May be out of plane if weatherstrip provides watertight seal.

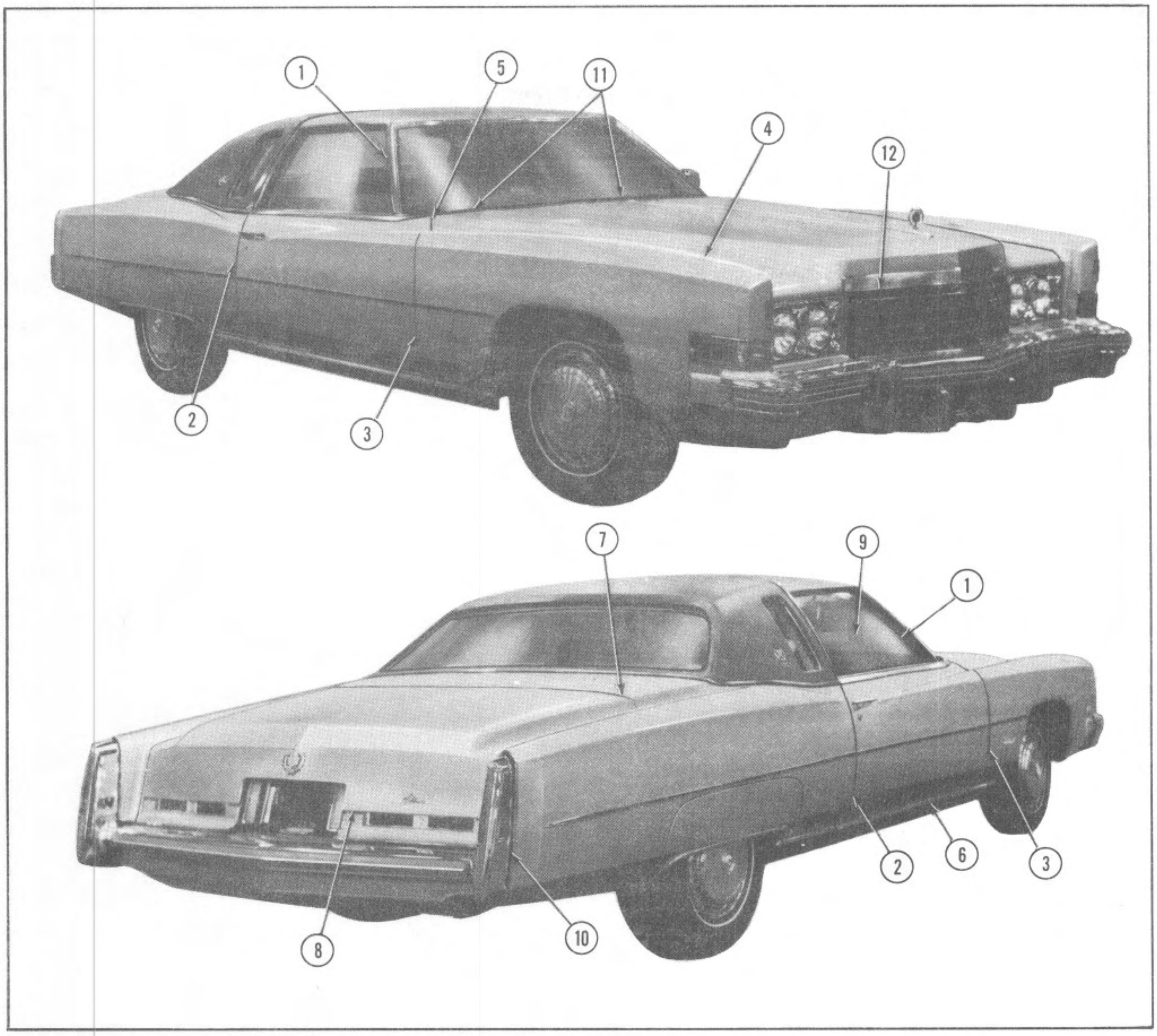


Fig. 11-8 Sheet Metal Tolerances—Eldorado

SHEET METAL TOLERANCES—ELDORADO

Location	Tolerance"	Flushness
1. Side window to windshield	3/8-7/16	—
2. Door to Quarter Panel	7/32-9/32	± 1/16
3. Door to Fender	1/8-1/4	± 1/16
4. Fender to Hood Panel Rear Extension	1/8-1/4	± 1/16
5. Hood to Fender or Hood Panel Rear Extension	3/32-5/32	± 1/16
6. Door to Rocker Panel	1/8-1/4	—
7. Trunk lid to Fender	1/16-1/4	± 1/16
8. Trunk lid to Bumper	1/2-3/4	—
9. Windows	5/16-3/8	*
10. Rear Bumper to Fender	1-23/32-1-31/32	—
11. Hood to Windshield Wiper Arm	1/8 Min.	—
12. Hood to Grille	7/16-13/16	—

*May be out of plane if weatherstrip provides watertight seal.

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HEADLIGHTS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE HEADLIGHT INOPERATIVE OR INTERMITTENT	
Loose connection.	Secure connections to sealed beam including ground (black wire).
Defective sealed beam.	Replace.
ONE OR MORE HEADLIGHTS ARE DIM	
Open ground connection at headlight.	Repair black wire connection between sealed beam and body ground.
Black ground wire mislocated in headlight connector (Type 2 Sealed Beam).	Relocate.
ALL HEADLIGHTS INOPERATIVE OR INTERMITTENT	
Loose connection.	Check and secure connections at foot switch and light switch and ground wire connections.
Defective foot switch.	Check voltage at foot switch with test bulb. If bulb lights only at light blue wire terminal, replace foot switch.
Open wiring – light switch to foot switch.	Check voltage at light blue wire with test bulb. If bulb lights at light switch light blue wire terminal but not at foot switch, repair open wire.
Open wiring – light switch to battery.	Check voltage at light switch yellow wire terminal with test bulb. If bulb fails to light, repair open yellow wire circuit to battery (possible open fusible link).
Circuit shorted to ground.	If, after a few minutes operation, headlights cycle on and off and/or a clicking noise can be heard from the light switch (circuit breaker opening and closing), repair short to ground in circuit between light switch and headlights. After repairing short, check for headlight flickering after one minute operation. If flickering occurs, the circuit breaker has been damaged and light switch must be replaced.
Defective light switch.	Check voltage at light switch yellow and blue wire terminals with test bulb. If bulb lights at yellow wire terminal but not at light blue, replace light switch.
UPPER OR LOWER BEAM WILL NOT LIGHT OR INTERMITTENT	
Open connection or defective foot switch.	Check voltage at foot switch headlight terminals with test light. If bulb lights at headlight terminals (light green - High Beam, Tan - Low Beam), repair open wiring between foot switch and headlights. If bulb will not light at one of the foot switch headlight terminals, replace foot switch.
Circuit shorted to ground.	Follow diagnosis shown above under "All Headlights Inoperative or Intermittent."
Defective sealed beam.	Replace.

TURN SIGNAL AND HAZARD WARNING LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
TURN SIGNAL INOPERATIVE – ONE SIDE	
Bulb out (flasher cannot be heard).	Turn on hazard warning system. If one or more lamps do not operate, check for defective bulb.
Open wiring or ground connection.	Turn on hazard warning system. If one or more bulbs do not operate, use 12 volt test lamp to check voltage at lamp socket. If test bulb lights, repair open ground connection. If not, repair open wiring between bulb socket and turn signal switch.
Improper bulb or defective turn signal switch.	Turn on hazard warning system. If all front and rear lamps operate, check for improper bulb (should be 1157 in rear, and 1157 NA in front). If bulbs are OK, replace defective turn signal switch.
Short to ground (flasher can be heard, but no lamps operate).	Locate and repair short to ground by disconnecting front and rear circuits separately.
TURN SIGNALS INOPERATIVE – BOTH SIDES	
Open fuse (turn signal).	Turn on hazard warning system. If all lamps operate, replace turn signal fuse if blown. If new fuse blows, repair short to ground between fuse and lamps.
Defective flasher (located behind instrument panel near steering column).	If turn signal fuse is OK, and hazard warning system will operate lamps, replace defective turn signal flasher (behind instrument panel near steering column).
Loose connection.	Secure steering column connector. If test bult lights only on one side of purple wire terminals in connector, clean or tighten connector contacts.
Open wiring or defective turn signal switch.	If test bulb lights when connected to both sides of purple wire connection in steering column connector, replace defective turn signal switch. If test bulb does not light on either side of the connector, repair open circuit between fuse and connector.
HAZARD WARNING LAMPS INOPERATIVE	
Open fuse (stop-hazard).	Switch on turn signals. If lamps operate, replace stop-hazard fuse if blown. If new fuse blows, repair short to ground. (Could possibly be in stop light circuit.)
Defective flasher (located on fuse panel).	If stop-hazard fuse is OK, switch on turn signals. If lamps operate, replace defective hazard flasher (on fuse panel).
Open wiring or defective turn signal switch.	With 12 volt test bulb, check voltage at brown wire in turn signal steering column connector. If test bulb does not light on either side of connector, repair open circuit between flasher and connector. If test bulb lights only on feed side of connector, clean connector contacts. If test bulb lights on both sides of connector, replace defective turn signal switch assembly.

CORNERING LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE LAMP INOPERATIVE	
Loose connection.	Secure connector near lamp.
Bulb out.	Replace burned out bulb.
Open ground connection.	If bulb is known good and test bulb lights at connector near lamp, repair open ground connection through lamp mounting.
Open wiring.	If test bulb lights on both sides of steering column connector, repair open wiring between connector and lamps. If not, check for open connection in connector.
Defective directional signal switch.	If test bulb lights at brown wire terminals of steering column connector but not at gray (left turn) or black/white (right turn) terminal, replace directional signal switch.
BOTH LAMPS INOPERATIVE	
Tail lamp fuse blown.	If tail lamps do not light, replace tail lamp fuse if blown. If new fuse blows, repair short to ground between fuse and lamps.
Cornering-park lamp fuse blown.	If the cornering and park lamps do not light, and the tail lamps do light, replace cornering and park lamp fuse. If new fuse blows, repair short to ground between fuse and lamps.
Loose connection.	Secure connectors at light switch and steering column.
Open wiring.	If tail lamps light, check voltage at steering column connector brown wire. If test bulb lights on lamp side of connector only, repair terminal. If tail lamps do not light, check for open wiring between light switch and battery.
Defective directional signal switch.	If tail lamps light, and test bulb lights on both sides of steering column connector, replace directional signal switch.
Defective light switch.	If tail lamps do not light and test bulb lights at light switch terminal #5 but not at #4, replace light switch.

SIDE MARKER LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE LAMP INOPERATIVE	
Side marker bulb out.	Replace burned out bulb.
Loose connection or open wiring.	Check voltage at bulb socket brown wire terminal with test bulb. If bulb lights, repair open ground circuit. If bulb does not light, repair open brown wire circuit.
FRONT OR REAR LAMPS INOPERATIVE	
Loose connection or open ground connection.	If associated tail or park lamps do not operate, secure all connectors in brown wire circuit. If park lamps operate, repair open ground connections through lamp mounting.
Multiple bulbs out.	Replace burned out bulbs.
ALL LAMPS INOPERATIVE	
Tail lamp fuse blown.	If park and tail lamps do not operate, replace tail lamp fuse if blown. If new fuse blows, check for short to ground between fuse panel and lamps.
Cornering-park lamp fuse blown.	If the side marker and park lamps do not light, and tail lamps do light, replace cornering and park lamp fuse. If new fuse blows, repair short to ground between fuse and lamps.
Loose connection.	Secure connector to light switch.
Open wiring.	Check voltage at tail lamp fuse with test bulb. If bulb lights, repair open wiring between fuse and light switch. If not, repair open wiring between fuse and battery. (Possible open fusible link.)
Defective light switch.	If test bulb lights at light switch terminal #5 but not at terminal #4, replace light switch.

TAIL, PARK, AND LICENSE LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE SIDE INOPERATIVE	
Bulb out.	Replace.
Open ground connection at bulb socket or ground.	Jumper bulb base socket connection to ground. If lamp lights, repair open ground circuit through lamp mounting.
BOTH SIDES INOPERATIVE	
Tail lamp fuse blown.	Replace fuse. If new fuse blows, repair short to ground in brown wire circuit between fuse panel through light switch to lamps.
Cornering-park lamp fuse blown.	If the park lamps do not light and the tail lamps do light, replace cornering-park lamp fuse. If new fuse blows, repair short to ground between fuse and lamps.
Loose connection.	Secure connector at light switch.
Open wiring.	If test bulb does not light on either side of fuse, repair open circuit between fuse panel and battery. (Possible open fusible link.) If test bulb lights at light switch brown wire terminal (5), repair open wiring between light switch and lamps.
Multiple bulb burnout.	If test bulb lights at lamp socket brown wire terminal, replace bulbs.
Defective light switch.	If test bulb lights at light switch terminal #4 (light green/black) but not at terminal #5 (dark green), replace defective light switch.

STOP LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE BULB INOPERATIVE	
Bulb out.	Replace bulb.
ONE SIDE INOPERATIVE	
Loose connection, open wiring, or defective bulbs.	Turn on directional signal. If lamp does not operate, check bulbs. If bulbs are OK, secure all connections. If lamp still does not operate, check for open wiring with a test bulb.
Defective directional signal switch or cancelling cam.	If lamp will operate by turning on directional signal, the switch is not centering properly during cancelling operation. Replace defective cancelling cam or directional signal switch.
ALL INOPERATIVE	
Stop-hazard fuse blown.	Replace. If new fuse blows, repair short to ground in circuit between fuse and lamps.
Stop switch misadjusted or defective.	With test bulb check voltage with brake pedal depressed at white wire terminal in steering column connector. If bulb does not light, check stop switch for proper adjustment. If adjustment is OK, replace stop switch.
WILL NOT TURN OFF	
Stop switch misadjusted or defective.	Readjust properly. If switch still malfunctions, replace.

BACK-UP LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE LAMP INOPERATIVE OR INTERMITTENT	
Open ground connection.	Repair bulb ground through lamp mounting.
Loose connection.	Tighten connectors.
Bulb out.	Replace bulb.
BOTH LAMPS INOPERATIVE OR INTERMITTENT	
Fuse blown.	Replace fuse. If new fuse blows, repair short to ground in circuit from fuse through neutral-safety switch to back-up lamps.
Loose connection or open circuit.	Secure all connectors. If OK, check continuity by voltage checking circuit from fuse to lamps with test bulb. If test bulb does not light on either side of fuse, check for open circuit from ignition switch to fuse.
Neutral switch misadjusted (open when shift lever is in reverse position).	Adjust switch.
Defective neutral switch.	With ignition on, check voltage at terminals with switch in back-up position. If bulb lights at pink wire terminal but not at light green wire terminal, replace neutral switch.
Defective ignition switch.	If test bulb lights at ignition switch battery terminal but not at output terminal, replace ignition switch.
LAMPS WILL NOT TURN OFF	
Neutral switch misadjusted (closed when shift lever is not in reverse position).	Adjust switch.

SERVICE INFORMATION

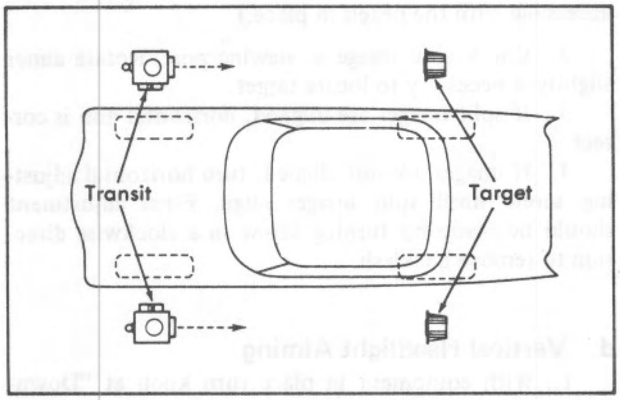


Fig. 12-1 Aiming Equipment Arrangement

1. Headlight Aiming-Mechanical Aimer Method

a. Adjusting Aimer for Floor Level

(NOTE: To obtain accurate headlight aim, the car must be placed on a flat surface.)

1. Drive car on selected area and place transit target at rear wheel on either side of car Fig. 12-1.

2. Place transit at front wheel on same side so target is visible, Fig. 12-1.

3. Adjust screw on back of transit until split image is aligned, Fig. 12-2.

4. Turn dial on side of transit until bubble is centered in level vial, Fig. 12-2.

Fig. 12-2 Adjusting Transit

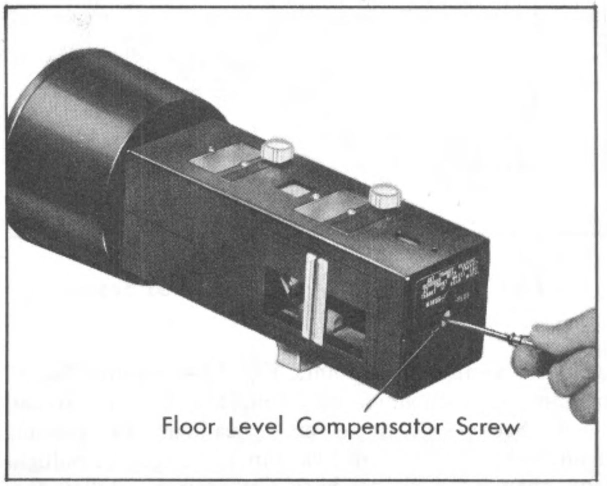


Fig. 12-3 Adjusting Floor Level Compensator

5. Turn floor level compensator on both aimers with screwdriver until adjoining dial reads same as dial on transit, Fig. 12-3.

(NOTE: Aimers must have floor level compensator readjusted for each new location if floor levels are different.)

b. Headlight Adjustment

1. Equalize tire pressure as recommended in Section 10, Fig. 10-1, and make certain car is at normal front standing height: Section 3, Note 1 on all but Eldorado style and Note 19 on the Eldorado. Make certain car is at normal rear standing height, Section 4, Note 1.

2. Turn on headlight units to make sure none is burned out. All four units should be on for high beam and only the two outer units should be on for low beam. Turn lights off for adjustment.

3. Clean headlight lens, Position aimers on outer headlights. Guide points must engage smooth inner ring

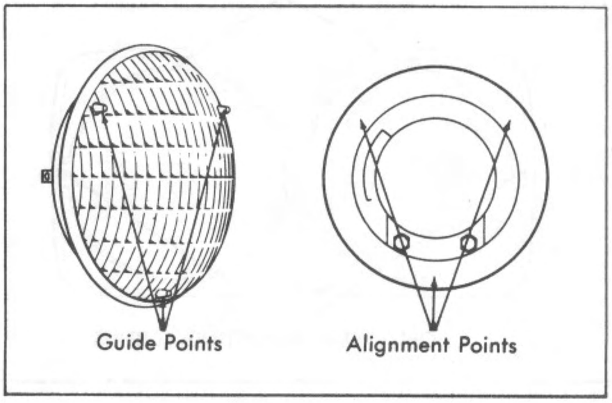


Fig. 12-4 Installing Aimer on Sealed Beam

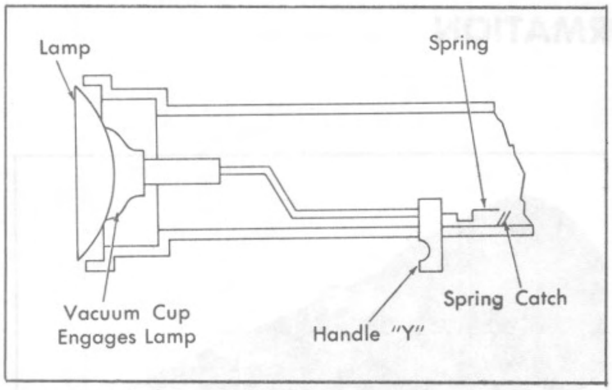


Fig. 12-5 Securing Aimer on Sealed Beam

of aimer at alignment points, Fig. 12-4 and the "sight" openings on each aimer must point toward center of car.

4. Secure aimer to each headlight by pressing handle "Y" forward until vacuum cup engages headlight lens, then draw handle back until spring catches, Fig. 12-5.

c. Horizontal Headlight Aiming:

1. Set "Right - Left" dial on zero, Fig. 12-6.

(NOTE: It is not necessary to remove the headlight bezels. The horizontal and vertical adjusting screws are accessible with the bezels in place.)

2. Check split image in viewing port. Rotate aimer slightly if necessary to locate target.

3. If split images are aligned, horizontal aim is correct.

4. If images are not aligned, turn horizontal adjusting screw until split images align. Final adjustment should be made by turning screw in a clockwise direction to remove backlash.

d. Vertical Headlight Aiming

1. With equipment in place turn knob at "Down-Up" dial until pointer is at zero on both aimers.

(NOTE: Individual State laws may vary and dealers should check with local authorities on the regulations of your State.)

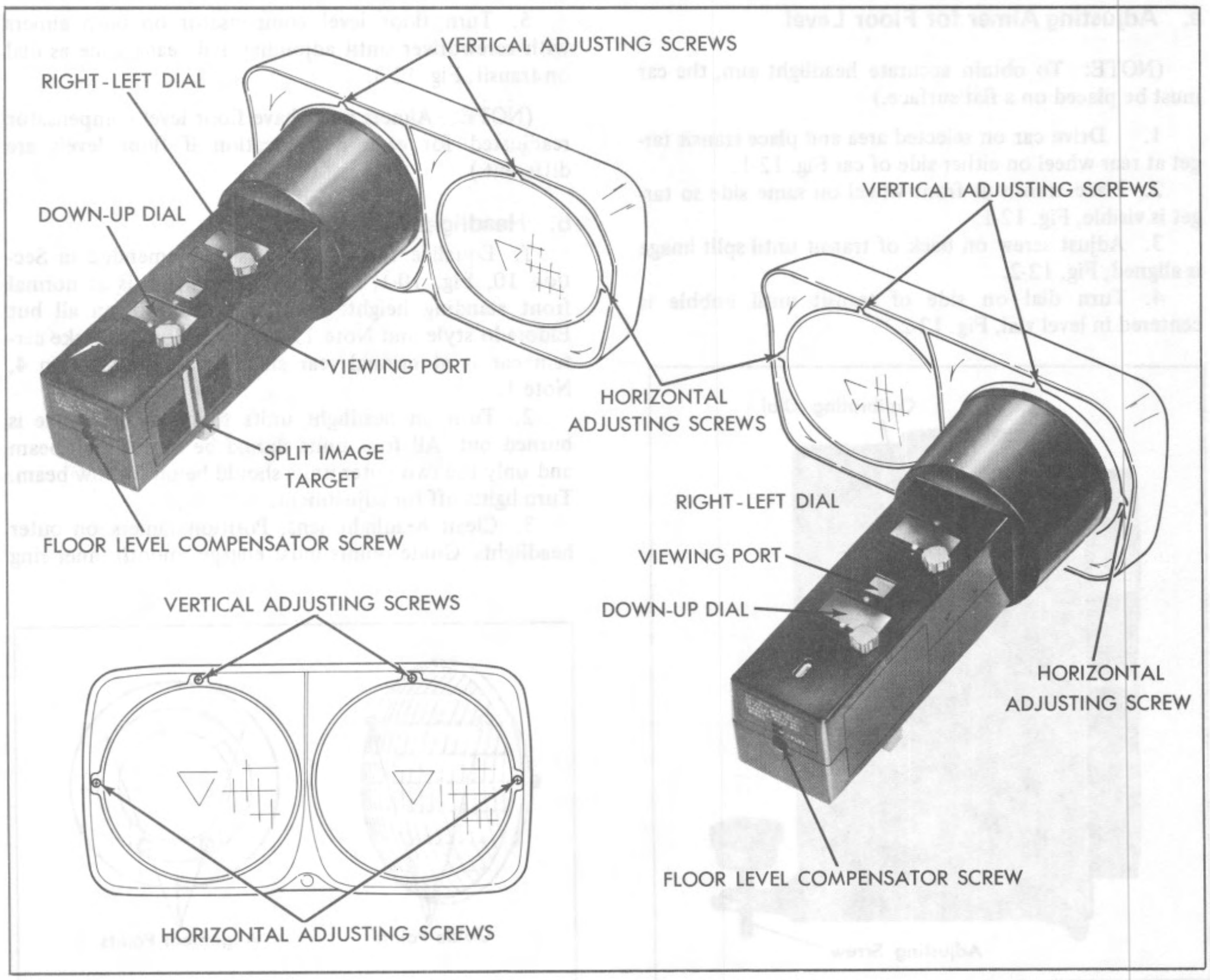


Fig. 12-6 Horizontal and Vertical Adjustments

2. Turn headlight vertical aiming screw counterclockwise until bubble is on car side of center. Turn screw clockwise until bubble is centered for correct aim and elimination of backlash, Fig. 12-6. Repeat horizontal and vertical adjustments on other headlight aimer.

3. Recheck target alignment on each side and re-adjust horizontal aim if necessary.

4. Hold aimer and release spring catch, Fig. 12-5. Push handle toward headlight to release aimer.

5. Repeat horizontal and vertical adjustments on inner set of headlights.

e. Calibrating Aiming Fixture

Aimer, J-6878-01, is calibrated by the manufacturer for use on a level floor. These aimers require no further change in calibration unless they are dropped or damaged in some manner.

1. With the aid of a good grade carpenter or stone mason spirit level, locate a vertical plate glass window, Fig. 12-7.

2. Set "Down-Up" pointer on zero. Set "Right - Left" pointer and floor level compensator on zero.

3. Secure aimers to plate glass window 3 to 5 feet apart so split image targets can be located in the viewing ports.

4. If bubble is centered in vial, vertical calibration is correct. If not centered, refer to Section f of this note for adjustments.

f. Re-Adjusting Headlight Aimer

1. With equipment left in place, turn level adjusting screw until bubble is centered on level to obtain correct vertical adjustment, Fig. 12-8.

2. Turn mirror adjustment screw until target split image becomes aligned, Fig. 12-9.

2. Headlight Aiming-Screen Method

The factory recommended headlight aiming specifications for the screen method are shown in Fig. 12-10.

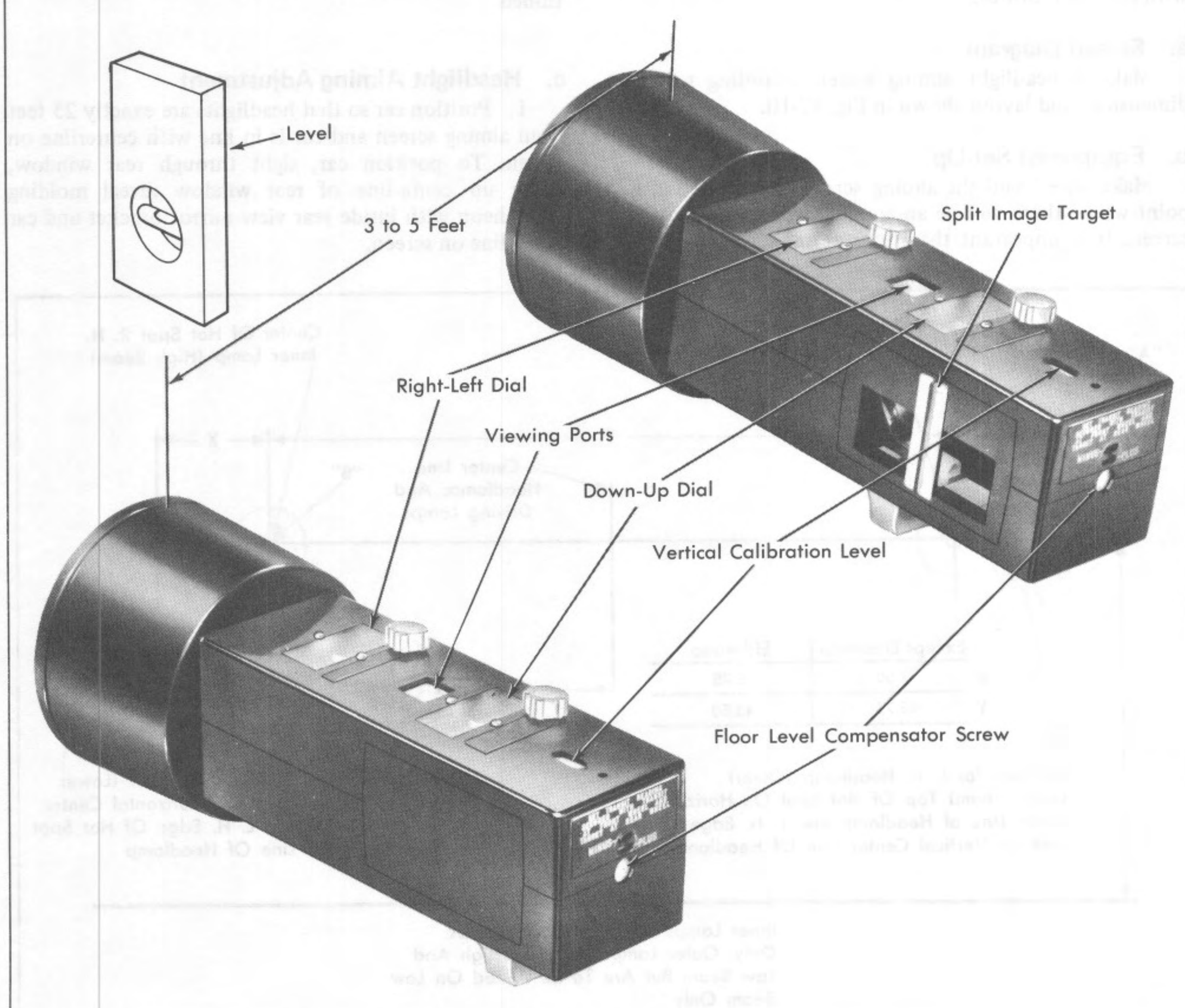


Fig. 12-7 Calibrating Headlight Aimers

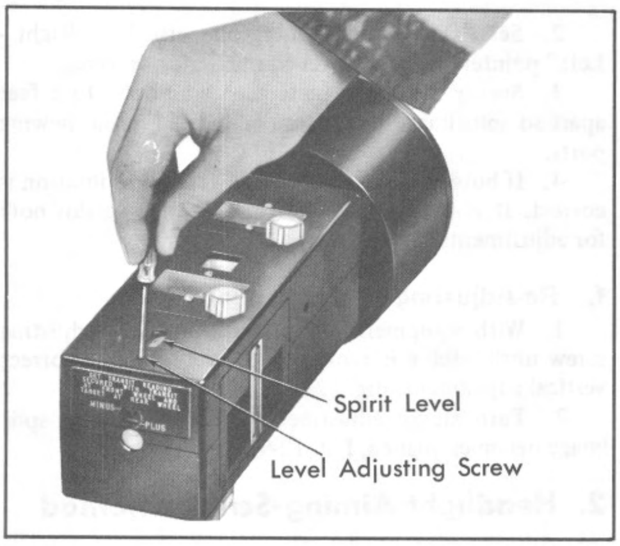


Fig. 12-8 Adjusting Vertical Aim

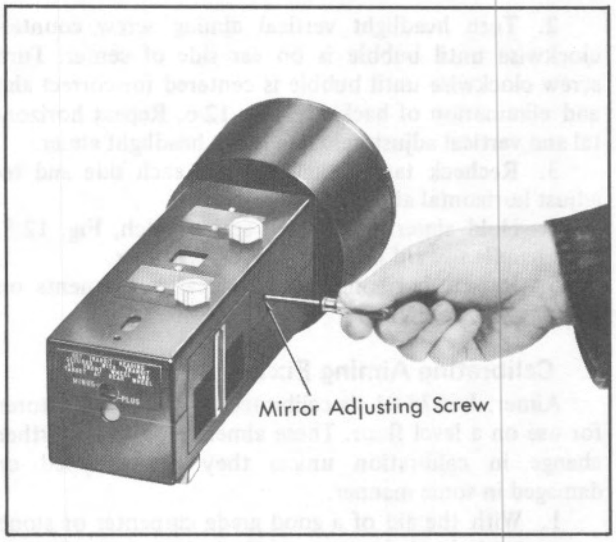


Fig. 12-9 Adjusting Horizontal Aim

Individual State laws may vary and dealers should check with local authorities.

a. Screen Diagram

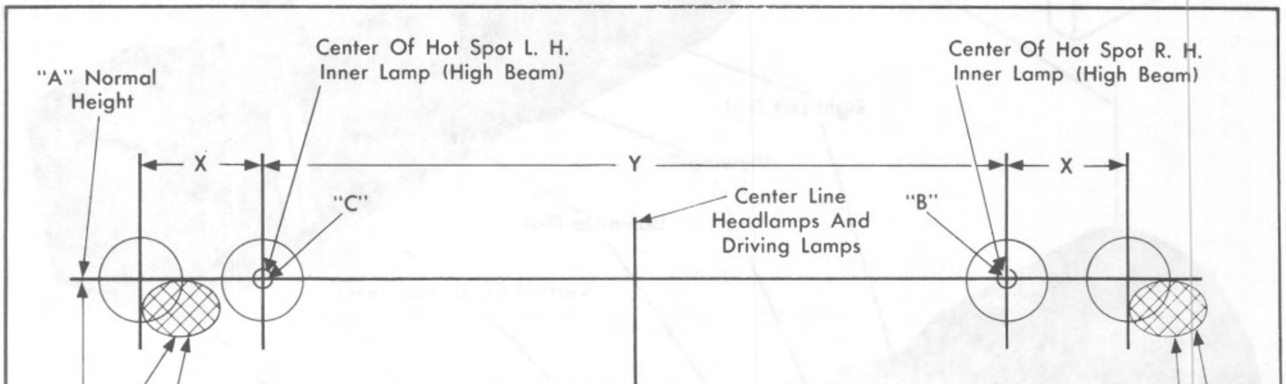
Make a headlight aiming screen according to the dimensions and layout shown in Fig. 12-10.

b. Equipment Set-Up

Make sure headlight aiming screen is mounted at a point where there will be an ample level area in front of screen. It is important that floor at aiming screen is at same level as the floor at the point where car is positioned.

c. Headlight Aiming Adjustment

1. Position car so that headlights are exactly 25 feet from aiming screen and car is in line with centerline on screen. To position car, sight through rear window, lining up centerline of rear window reveal molding escutcheon with inside rear view mirror bracket and car centerline on screen.



	Except Eldorado	Eldorado
X	7.50	6.25
Y	45.75	43.50

Fig. 12-10 Headlight Aiming Screen

2. Position two 36 inch sticks vertically at the left front and left rear wheels. Sight over sticks and move left side of screen up or down, as required, to line up horizontal headlight centerline on screen with the 36 inch sight line. Follow same procedure on right side.

3. Mark wall adjacent to horizontal centerline of headlight line on aiming screen. Subtract the curb height from 36. Using the new dimension, mark down on the wall from the 36 inch mark.

Move screen down until horizontal centerline of headlight is even with this point.

Series	Rear Suspension	Curb Height @ ℄ Headlamps
Brougham	All	26.67"
Calais, DeVille	Std.	26.28"
	A.L.C.	26.80"
75 Series	All	27.86"
Eldorado	All	26.78"
Commercial Chassis	All	27.83"

4. Set headlights on high beam. Make sure all four headlights are on.

5. Cover both left side headlights and right side outer light and adjust right inner light as required until hot spot centers at point "B" on screen, Fig. 12-10.

6. Cover both right side headlights and left side outer light and adjust left inner light as required until hot spot centers at point "C" on screen, Fig. 12-10.

7. Set headlight on low beam. Only outer headlights should light.

8. Cover left outer headlight and adjust right outer light as required until top of hot spot "D" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of outer light, Fig. 12-10.

9. Cover right outer headlight and adjust left outer light as required until top of hot spot "E" is on horizontal centerline of headlight and left edge of hot spot is on vertical center line of outer light, Fig. 12-10.

3. Sealed Beam Unit Replacement

1. Remove three screws securing headlight bezel to headlight assembly and remove bezel.

2. Remove three screws securing headlight retaining ring to mounting pads and remove retaining ring.

3. Remove sealed beam unit and disconnect lamp monitor system and electrical connector from unit.

4. Connect electrical connector and lamp monitor connector to new sealed beam unit and position sealed beam unit on mounting pads.

5. Install headlight retaining ring and secure with three attaching screws.

6. Install headlight bezel to headlight assembly and secure with three attaching screws.

7. Check operation of headlights and reset headlight aim as outlined in Notes 1 and 2.

4. Bulb Replacement (Except Eldorado)

It is necessary to carefully check the parts catalog for correct model application when replacing lamp socket assemblies. If incorrect sockets are used for replacement, the bulb filament will be in the wrong location with respect to the lens and/or reflector. As a result, the lamp may fail to meet the required lighting standards.

A complete list of replacement bulbs is given in the bulb chart, Page 12-19. The procedure for making replacements are outlined in this note except those that are exclusive to Eldorados, which are described in Note 12.

CAUTION: Make certain ignition switch and headlight switch are off when replacing bulbs.

a. Front Park - Signal Lamp, Cornering Lamp, Side Marker Lamp

Access to these bulbs is gained by removing the lamp housing as described in Note 6.

b. Rear Tail and Stop-Signal Lamp

Access to these bulbs is gained by removing the filler panel (three screws) and removing the lens. Commercial chassis bulb is accessible from under rear bumper.

c. Back-Up Lamp

Gain access to back-up lamp by removing appropriate filler panel (three screws) and removing the lens. Commercial chassis bulb is serviced from under rear bumper.

d. Rear Side Marker and Reflex

Remove lamp assembly (one screw) and move away from bumper.

e. License Plate Lamp

Access is gained by removing appropriate side filler panel (three screws).

f. Cruise Control Switch Lamp and Headlight Switch Lamps

Remove steering column lower cover as described in Note 31 for access to these bulbs. Remove climate control panel as described in Note 42 for access to upper headlight switch lamp.

g. Windshield Wiper Switch Lamp

Remove switch as described in Note 47 for access to this bulb.

h. Radio Dial Lamp

Dial lamp is replaced by removing the instrument panel pad on all radios except tape radio.

Access to the stereo AM/FM tape radio dial lamp is through the tape access door.

i. Clock Lamp, Warning Lamps

Remove instrument panel pad as described in Note 33 for access to these lamps.

j. Fuel Gage Lamp

Remove instrument panel pad (Note 32) and L.H. A/C Hose Adapter.

k. Instrument Cluster Lamps

Remove instrument cluster as described in Note 35 for access to all lamps in the cluster.

l. Accessory Switch Lamps

Remove right Insert and Applique as described in Note 51 for access to bulbs.

5. Headlamp Housing Assembly

a. Removal

1. Disconnect negative battery cable.
2. Loosen, but do not remove, two screws with shims securing bottom of headlamp housing to cradle, Fig. 12-1.
3. Remove screw and shims securing top of housing to radiator cradle tie bar, Fig. 12-11.
4. Pull housing forward, disconnect sealed beam and lamp monitor connectors, and remove housing.

b. Installation

1. Make sure rubber nipple is in place on exhaust nipple of sealed beam unit and connect lamp monitor and sealed beam connections to rear of housing.
2. Tape shims to lower radiator cradle so that they are not dislodged during installation.
3. Position housing and tighten lower mounting screws to 60 inch-pounds.
4. Install screw and shims securing top of housing to radiator cradle tie bar, tightening to 60 inch-pounds.
5. Connect negative battery cable and tighten to 70 inch-pounds. Check operation of lights and lamp monitor.
6. Reset headlight aim using technique outlined in Note 1 or Note 2.

6. Front Parking and Signal Lamp and Reflex Assembly

(NOTE: The lens on the park and signal lamp is not serviceable. It is permanently assembled to the housing.)

a. Removal

1. Disconnect negative battery cable.
2. Remove four screws securing bezel to lamp assembly and remove bezel, Fig. 12-12.
3. Remove two screws securing lamp assembly to fender, Fig. 12-12.

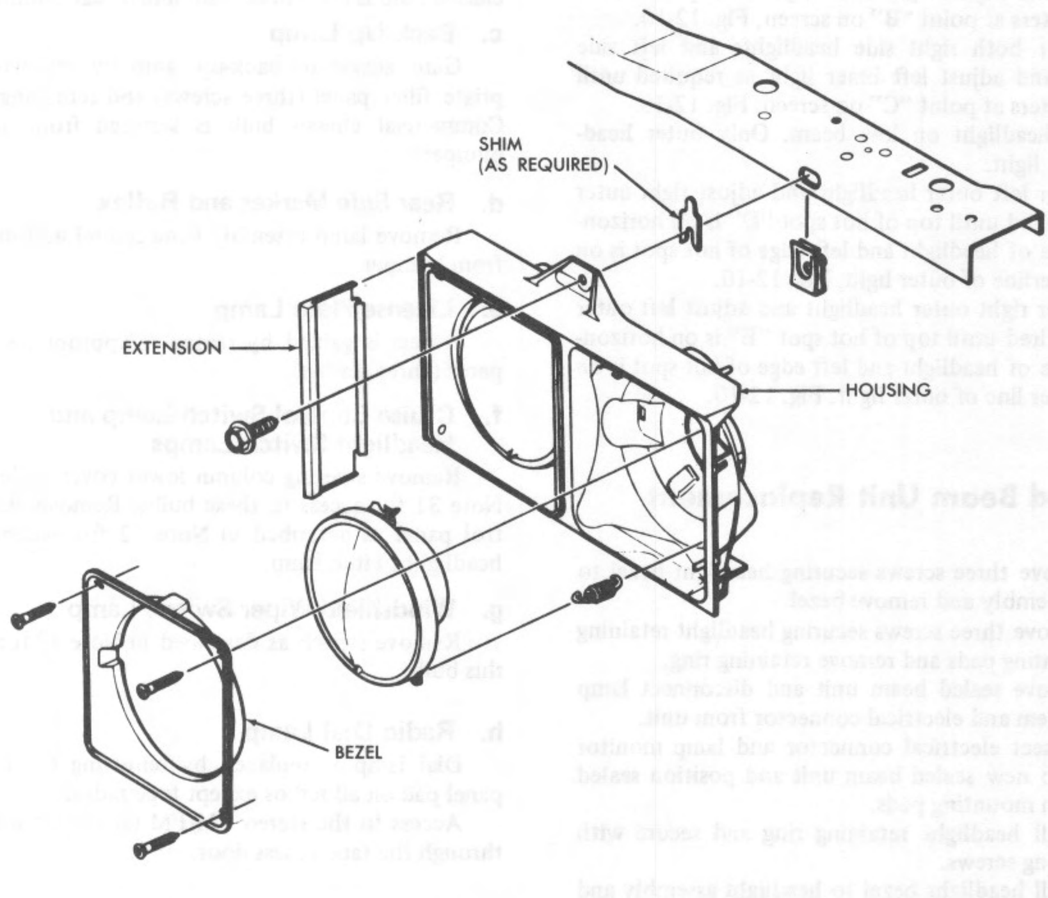


Fig. 12-11 Headlamps–Exploded View

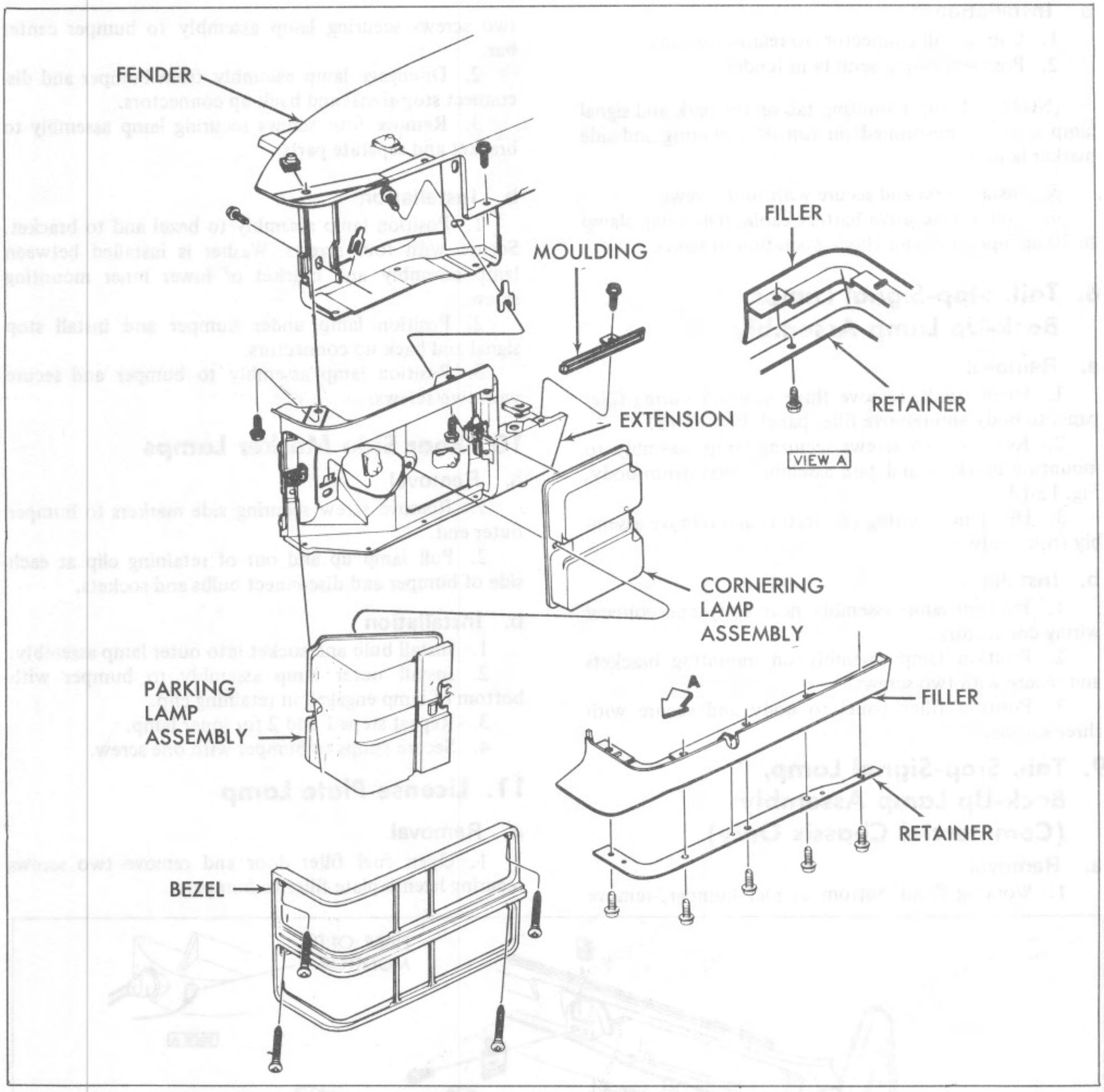


Fig. 12-12 Cornering Lamps—Exploded View

4. Pull lamp out and disconnect all connections to rear of housing.

b. Installation

1. Connect all connectors to rear of housing and install lamp in fender.
2. Install two screws securing lamp to fender.
3. Install bezel and secure with four screws.
4. Connect negative battery cable, tightening clamp to 70 inch-pounds, and check operation of lights.

7. Front Cornering and Side Marker Lamp Assembly

(NOTE: The lens on the cornering and side marker lamp is not serviceable. It is permanently assembled to the housing.)

a. Removal

1. Disconnect negative battery cable.
2. Remove four screws securing bezel to lamp assembly and remove bezel, Fig. 12-12.
3. Pull lamp assembly from fender, Fig. 12-12 and disconnect all connectors from rear of housing.

b. Installation

1. Connect all connectors to rear of housing.
2. Position lamp assembly in fender.

(NOTE: Lamp mounting tab on the park and signal lamp must be positioned on top of cornering and side marker lamp.)

3. Install bezel and secure with four screws.
4. Connect negative battery cable, tightening clamp to 70 inch-pounds, and check operation of lights.

8. Tail, Stop-Signal Lamps, Back-Up Lamp Assembly

a. Removal

1. Open trunk, remove three screws securing filler panel to body and remove filler panel, Fig. 12-13.
2. Remove two screws securing lamp assembly to mounting brackets and pull assembly away from body, Fig. 12-13.
3. Disconnect wiring connectors and remove assembly from body.

b. Installation

1. Position lamp assembly near body and connect wiring connectors.
2. Position lamp assembly on mounting brackets and secure with two screws.
3. Position filler panel to body and secure with three screws.

9. Tail, Stop-Signal Lamp, Back-Up Lamp Assembly (Commercial Chassis Only)

a. Removal

1. Working from bottom of rear bumper, remove two screws securing lamp assembly to bumper center bar.
2. Disengage lamp assembly from bumper and disconnect stop-signal and back-up connectors.
3. Remove four screws securing lamp assembly to bracket and separate parts.

b. Installation

1. Position lamp assembly to bezel and to bracket. Secure with four screws. Washer is installed between lamp assembly and bracket of lower inner mounting screw.
2. Position lamp under bumper and install stop signal and back up connectors.
3. Position lamp assembly to bumper and secure with two screws.

10. Rear Side Marker Lamps

a. Removal

1. Remove screw securing side markers to bumper outer end.
2. Pull lamp up and out of retaining clip at each side of bumper and disconnect bulbs and sockets.

b. Installation

1. Install bulb and socket into outer lamp assembly.
2. Install outer lamp assembly to bumper with bottom of lamp engaged in retaining clip.
3. Repeat steps 1 and 2 for inner lamp.
4. Secure lamps to bumper with one screw.

11. License Plate Lamp

a. Removal

1. Open fuel filler door and remove two screws securing license plate filler to bumper.

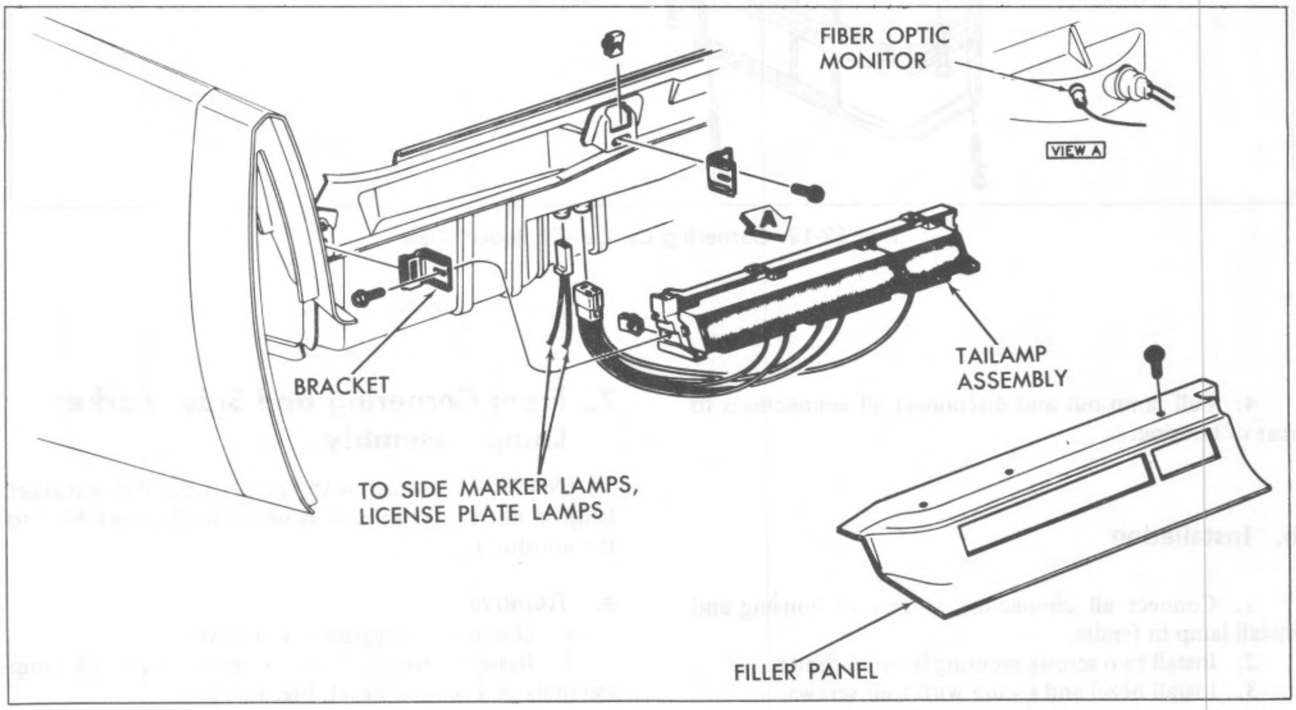


Fig. 12-13 Tail Lamps—Exploded View

2. Remove one screw securing lamp assembly to bumper and remove lamp.
3. Disconnect light bulb by twisting socket.

b. Installation
1. Position lamp housing behind bumper and install light bulb socket.
2. Position lamp assembly to bumper and secure with one screw, working through license filler area.
3. Position license filler and secure with two screws.

12. Bulb Replacement (Eldorado)

A complete list of replacement bulbs is given in the bulb chart on page 12-19. The procedures for making replacements given in this note are exclusive to the Eldorado. Bulbs not listed here will be described in Note 4.

CAUTION: Make certain ignition switch and headlight switch are off when replacing bulbs.

a. Front Parking, Turn Signal, Cornering, Side Marker Lamps
Reach under fender and twist socket to remove.

b. Back-Up Lamp
Remove lens (two screws) for access to bulb.

c. Read Side Marker Lamp
Remove lamp assembly from bumper (one screw) and twist socket out of housing.

13. Front Parking, Signal, Cornering Lamp and Side Marker Assembly—Eldorado

(NOTE: Removal of either or both lenses, bezels, bumper stop, or bumper-to-housing filler strip requires removal of housing from car.)

a. Removal
1. Disconnect negative battery cable.
2. Disconnect bulb sockets and Lamp Monitor conductors from back of housing.
3. Remove three nuts and washers securing front fender nose cap to front fender and remove nose cap, Fig. 12-14.

(NOTE: There are two ways of gaining access to these nuts. One method is to first remove headlamp housing and use ratchet and socket from inboard side of nose cap. The alternative is to use a deep socket and about 15 inches of extension and, working inside fender, insert socket and extension in each access hole in turn until all three nuts are removed.

In either case once nose cap is removed, do not thread or unthread nose cap studs and do not disturb position of remaining three nuts and washers, as these control alignment of nose cap to fender.)

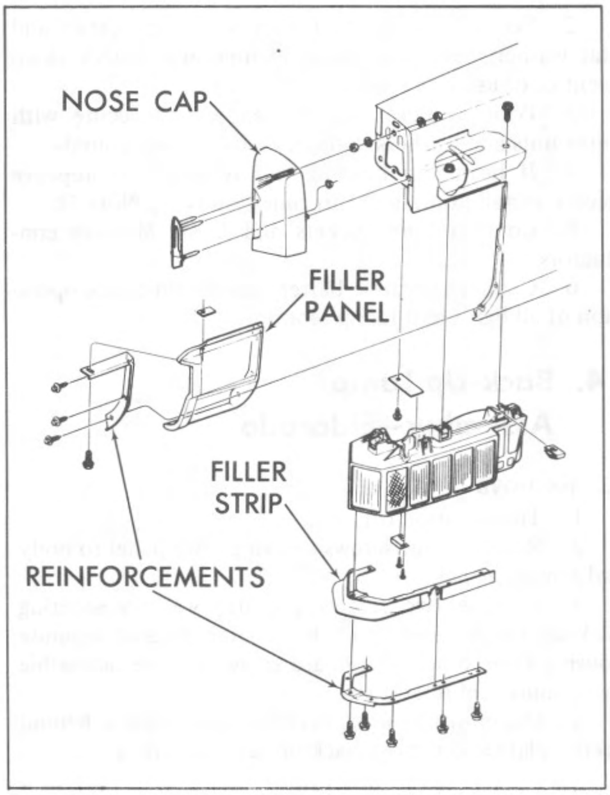


Fig. 12-14 Front Signal Lamp Assembly – Eldorado

4. Working inside fender, remove two nuts and star washers securing top of cornering light housing to fender, Fig. 12-14.
5. Pull housing assembly forward and out of car.

b. Disassembly
1. Remove five screws securing filler strip and metal reinforcement to bottom of housing and remove strip and reinforcement, Fig. 12-14.
2. Remove parking and signal light bezel by removing two screws from top of bezel and one from bottom. Lens can then be removed by hand.
3. Remove cornering light bezel by removing four screws securing bezel to housing. Lens can then be removed by hand.
4. Remove two screws securing bumper stop to bottom of housing and remove bumper stop.

c. Assembly
1. Secure bumper stop to bottom of housing with two screws.
2. Position cornering lamp to lens over housing. Place bezel over lens and secure to housing with four screws.
3. Place parking and signal lamp lens on housing and place bezel over lens. Secure with three screws.
4. Place filler strip and reinforcement on bottom of housing. Tighten five screws to 20 inch-pounds.

d. Installation
1. Make sure U-nuts are in place and insert housing between bumper and fender by sliding from front to rear.

2. Secure housing to fender with two screws and star washer, tightening to 60 inch-pounds. Check alignment of housing to fender.

3. Position nose cap on fender and secure with three nuts and washers, tightening to 45 inch-pounds.

4. If headlamp housing was removed to improve access, install housing at this time, following Note 5b.

5. Connect bulb sockets and Lamp Monitor conductors.

6. Connect negative battery cable and check operation of all lights and Lamp Monitor.

14. Back-Up Lamp Assembly—Eldorado

a. Removal

1. Turn ignition off.

2. Remove four screws securing filler panel to body and remove panel.

3. Remove two screws and star washers securing back-up lamp housing to body bracket and separate housing from bracket. Inboard screw is made accessible by opening fuel filler door.

4. Disconnect wiring harness at connector behind license plate and remove back-up lamp assembly.

b. Installation

1. Open fuel filler door, make sure U-nuts are in place, position lamp assembly on bracket, and secure with two screws and washers, tightening to 60 inch-pounds.

(NOTE: Make sure proper alignment is obtained. Vertical adjustment is achieved through slotted holes in housing, horizontal adjustment by slotted holes in body bracket.)

2. Connect wiring behind license plate.

3. Secure trim panel with four screws.

15. License Plate Lamp Assembly—Eldorado

a. Removal

1. Remove two screws and star washers securing lamp housing to fuel filler door.

2. Pull lamp housing down to gain access to connector.

3. Remove bulb socket from housing by turning counterclockwise.

4. Remove bulb from socket.

b. Installation

1. Install bulb in socket.

2. Install socket in housing by inserting and turning clockwise.

3. Position housing on fuel filler door and secure with two screws and star washers. Secure ground strap under left U-nut.

BULB DATA CHART

FUNCTION	BULB NUMBER	CANDLEPOWER
Accessory Switch Illumination	1445	.7
Ash Tray Lamp	1445	.7
Back-Up Lamp	1156	32
Clock	1895	2
Cornering Lamp	1295	50
Courtesy Lamp-Instrument Panel	89	6
Courtesy Lamp-Rear Door Rear Quarter Armrest	212/212-1/212-2	6
Courtesy Lamp-Sail Panel	90	6
Cruise Control Speed Selector, Illumination, Auto. Lock Lamps	53	1
Fuel Gage	1895	2
Generator Telltale Lamp	194	2
Glove Compartment Lamp	1816	3
Headlamp-Inner	5001	50.0 Watts
Headlamp-Outer	4000	37.5W/60.0W
Headlamp Switch Lamp	1816	3
Heater Control or Climate Control Lamp	1816	3
High Beam Indicator	194	2
Instrument Panel Lamp	161	1
License Lamp (exc. Commercial Chassis)	194	2
License Lamp–Commercial Chassis	67	4
Low Brake Telltale Lamp	194	2
Low Oil Pressure Telltale Lamp	194	2
Low Washer Fluid Telltale	161	1
Map Lamp	562	6
Marker Lamp-Front Side	97A/97NA	4
Marker Lamp-Rear Side (Eldorado)	168	3
Marker Lamp-Rear Side (ex. Eldorado)	194	2
Opera Lamp	756	.3
Park-Signal Lamp	1157NA	24/2.2
Radio Dial Lamp	1895	2
Radio AM-FM Band, Stereo or Tape Indicators	*Special	–
Radio-Rear Control Indicator	250	1
Rear Window Defogger Indicator Lamp	1445	.7
Seat Belt Telltale	194	2
Spot Lamp-Front Compartment	90	2
Spot Lamp-Reading	1004	15
"Stop Engine Temp" Warning Light	194	2
Stop, Tail, and Signal	1157	32/3
Trunk Compartment Lamp	1003	15
Trunk Lid Telltale	161	1
Turn Signal Indicator	194	2
Warning Lamp Door (Combined with Courtesy Light)	212/212-1/212-2	6
Water Temperature Telltale	194	2
Windshield Wiper Switch Illumination	194	2
Vanity Mirror	562	6

*Serviceable only by Radio Technician.

16. Fuse Panel and Fuses

The Fuse Panel, Fig. 12-15, contains all electrical system fuses except those listed in the chart on page 12-21. In addition the starter motor is protected by "fusible link" wires. Refer to Section 6, Note 28 for servicing the fusible links.

The fuse panel is located on the firewall under the instrument panel to the left of the steering column. Fuses can be replaced by reaching up under the panel. However, on cars equipped with Theft Deterrent System, the system must be disarmed before removing the special fuse block cover or the alarm will operate. The fuse block and fuse locations are shown in Fig. 12-15. Fuses are color-striped according to the following chart:

Fuse	Color Stripe
3 amp	Violet
7-1/2 amp	Brown
10 amp	Red
15 amp	Lt. Blue
25 amp	White

For service replacement, common unstriped fuses of the same amperage size may be used.

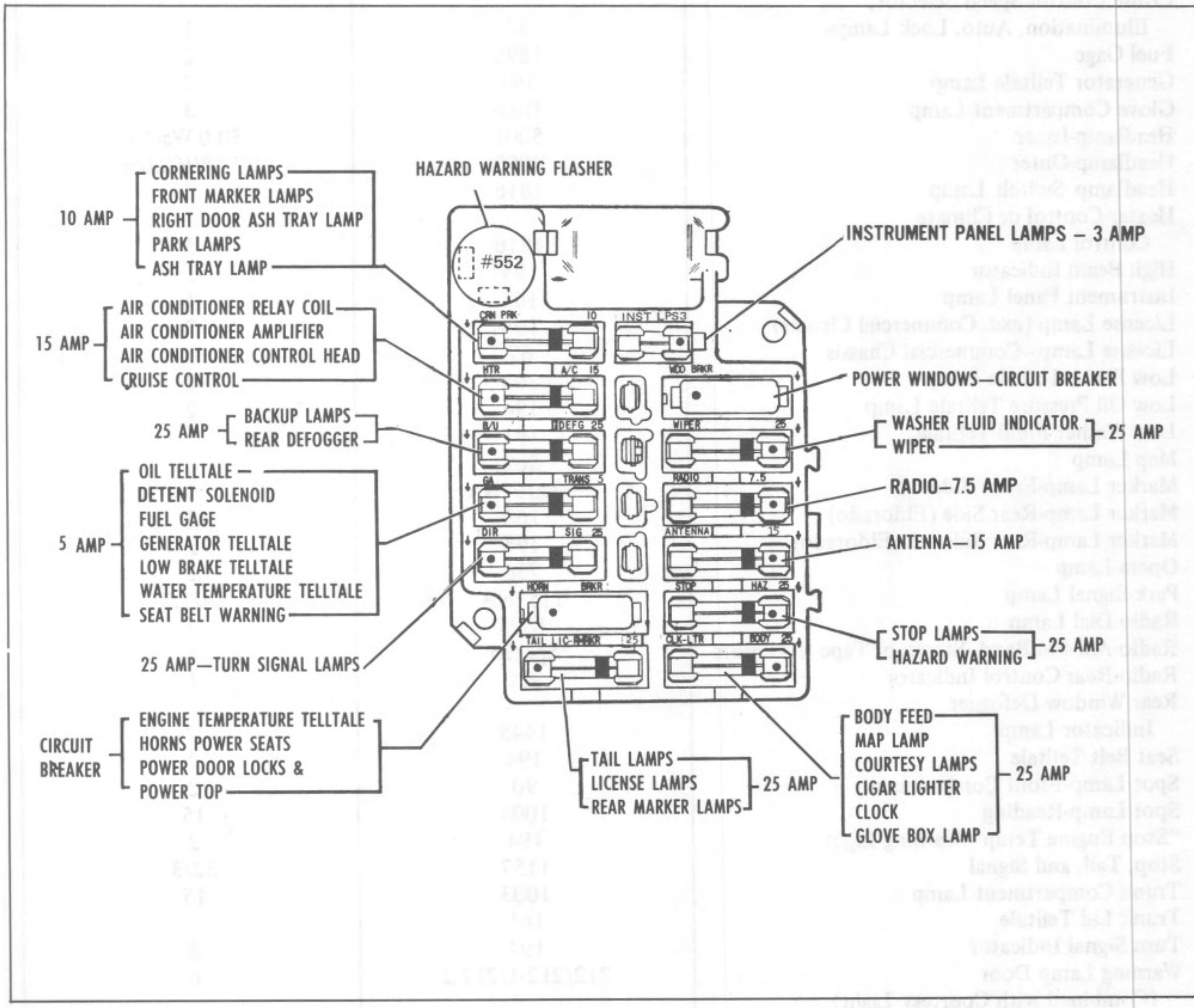


Fig. 12-15 Fuses and Fuse Panel

FUSES, CIRCUIT BREAKERS, FLASHERS EXTERNAL TO FUSE PANEL

Circuit	Location	Device
Headlights	Integral with Headlight Switch	Circuit Breaker
Rear Window Defogger	In Line near Fuse Panel (Approx. 5" from Panel – Yellow Wire)	25 Amp Fuse
Sunroof	On Left Hand Instrument Panel Brace	Circuit Breaker
Trackmaster	In Line near Fuse Panel (Approx. 8" from Panel – Pink Wire)	4 Amp Fuse
Vanity Mirror	Behind Mirror	2 Amp Fuse
Turn Signal Flasher	Behind Steering Column Lower Cover	#323 Flasher
Twilight Sentinel	Integral with Headlight Switch	Circuit Breaker
Air Cushion Restraint System	In Line near Sensor-Recorder (Below Radio)	20 Amp Fuse

WINDSHIELD WIPER SYSTEM
GENERAL DESCRIPTION

Service information pertaining to the windshield wiper and washer system not found in this section is covered in the body service manual. Information on the controlled cycle wiper system will be found in Section 15 of this manual.

Windshield Wiper Electrical Operation

LOW SPEED – Moving the control switch lever to the "Lo" speed position, Fig. 12-16, connects the relay control and shunt field circuit directly to ground, Fig. 12-17. This provides the following circuit:

Current feed to the 25 amp windshield wiper fuse in the fuse panel comes from the accessory terminal on the ignition switch. Current flows through the yellow wire to terminal number 2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch, and on through the relay coil and through the red wire back to terminal No. 1, through the light blue wire and the switch to ground. After passing through the relay points, current flows through the black with double pink tracer wire through the series field and divides; part flowing through the armature and circuit breaker and through the black ground wire, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with double orange tracer wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal No. 3 at this time, because of the lower resistance of the control switch ground circuit.

MEDIUM SPEED – Moving the control switch to the "Medium" speed position, Fig. 12-17, connects a 13 ohm resistor, located in the control switch, in parallel with the 20 ohm resistor connected from the shunt field circuit. These two resistors, connected in parallel, provide slightly less than 8 ohms resistance in the shunt field, allowing less current to flow in the shunt field. This permits correspondingly more current in the armature circuit, resulting in medium speed.

HIGH SPEED – Moving the control switch lever to the "High" speed position, Fig. 12-17, eliminates the path to ground in the control switch, leaving only the 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at either medium or low speeds, which results in high speed operation.

MIST – Moving the control lever down to the "Mist" position, Fig. 12-17, and holding there until the wipers move out of the park position before releasing, will allow the wipers to make one complete low speed cycle wipe of the windshield and return to the park position.

Washer Circuit

Depressing the washer button on the control switch, Fig. 12-16, mechanically moves the wiper switch lever to the "Lo" speed position. The washer relay coil is energized by the current flowing from the No. 2 terminal on the wiper unit connector through the yellow wire into the relay coil and from there through the dark blue with white striped wire to ground.

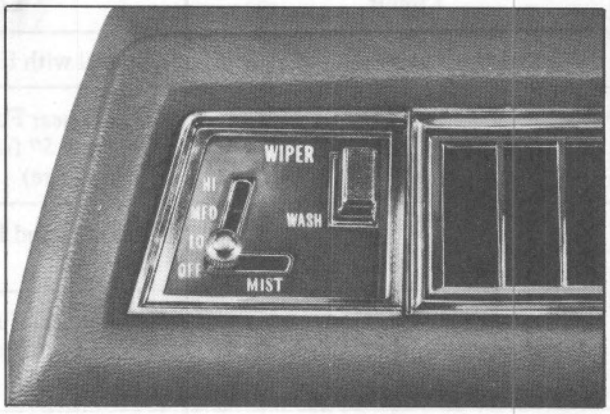


Fig. 12-16 Windshield Wiper Switch

Engine Metal Temperature System Circuitry

When engine metal temperature exceeds 320°F, the engine temperature switch closes. Current from the horn circuit breaker flows through the 14 orange with black stripe wire, through the relay coil, through the normally closed (N.C.) contact points, through the 18 white wire to the bulkhead connector. The current then flows through the bulkhead connector, through the 18 dark green with white stripe wire to the engine temperature sending unit switch, and then through the switch to ground.

When the engine metal temperature switch is closed, the ground is also completed for the engine metal temperature tell-tale light that draws its feed from the horn (CB) fuse through the 16 orange with black stripe wire. Current flows through the engine metal temperature tell-tale light, illuminating this light, through the violet with white stripe wire to the bulkhead connector, through the 18 dark green with white stripe wire to ground at the switch.

When the relay coil is energized, the normally closed contacts open, breaking the circuit and de-energizing the coil. This, in turn, allows the normally closed contacts to close again, completing the circuit and energizing the coil again. As the normally closed contacts open and close in rapid succession, the buzzer sound is produced.

(NOTE: When engine metal temperature exceeds 320°F, energizing the warning buzzer coil, it will continue to buzz until the engine cools below 240°F. even with the ignition switch turned Off.)

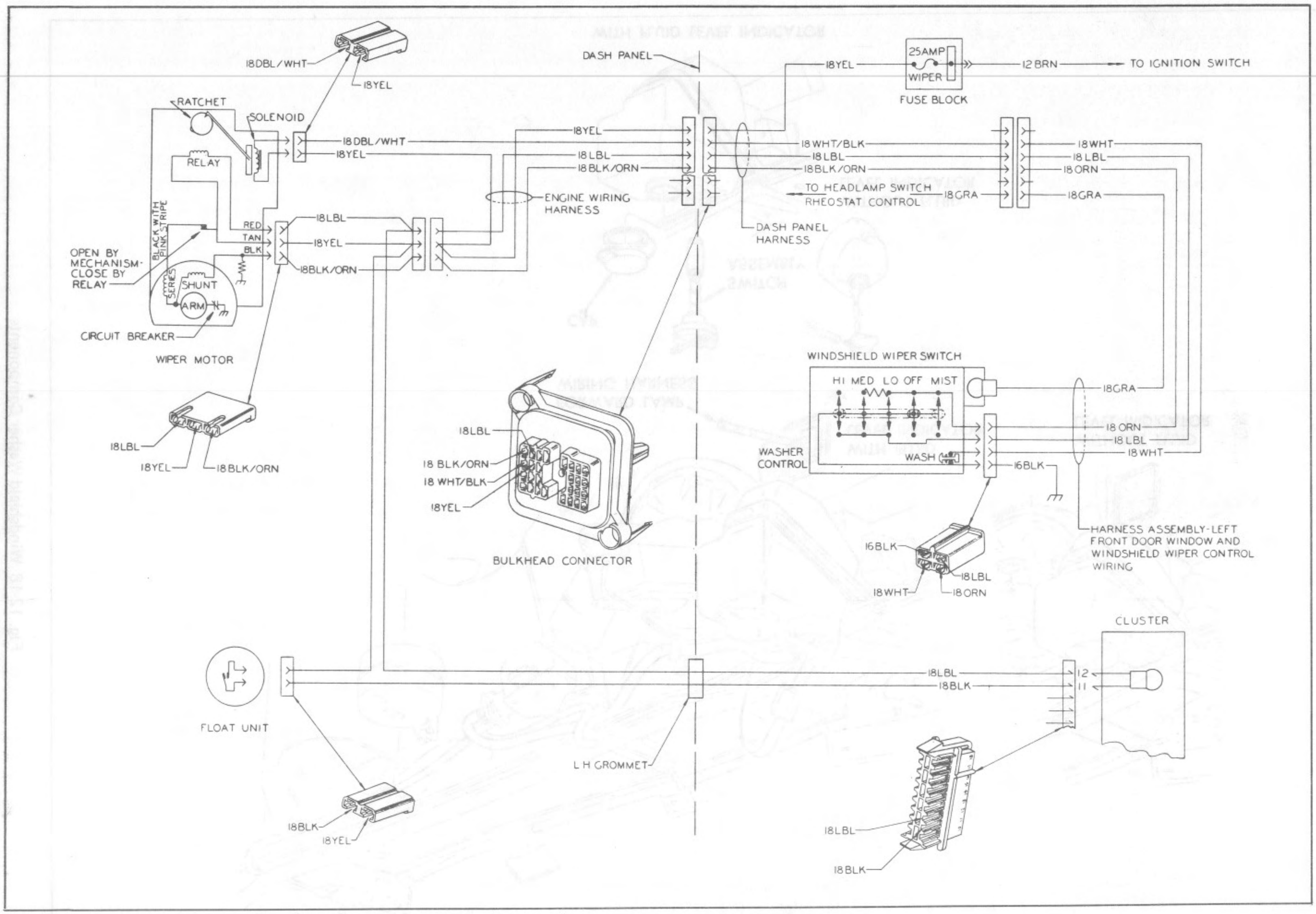


Fig. 12-17 Wiper and Washer Electrical Circuit

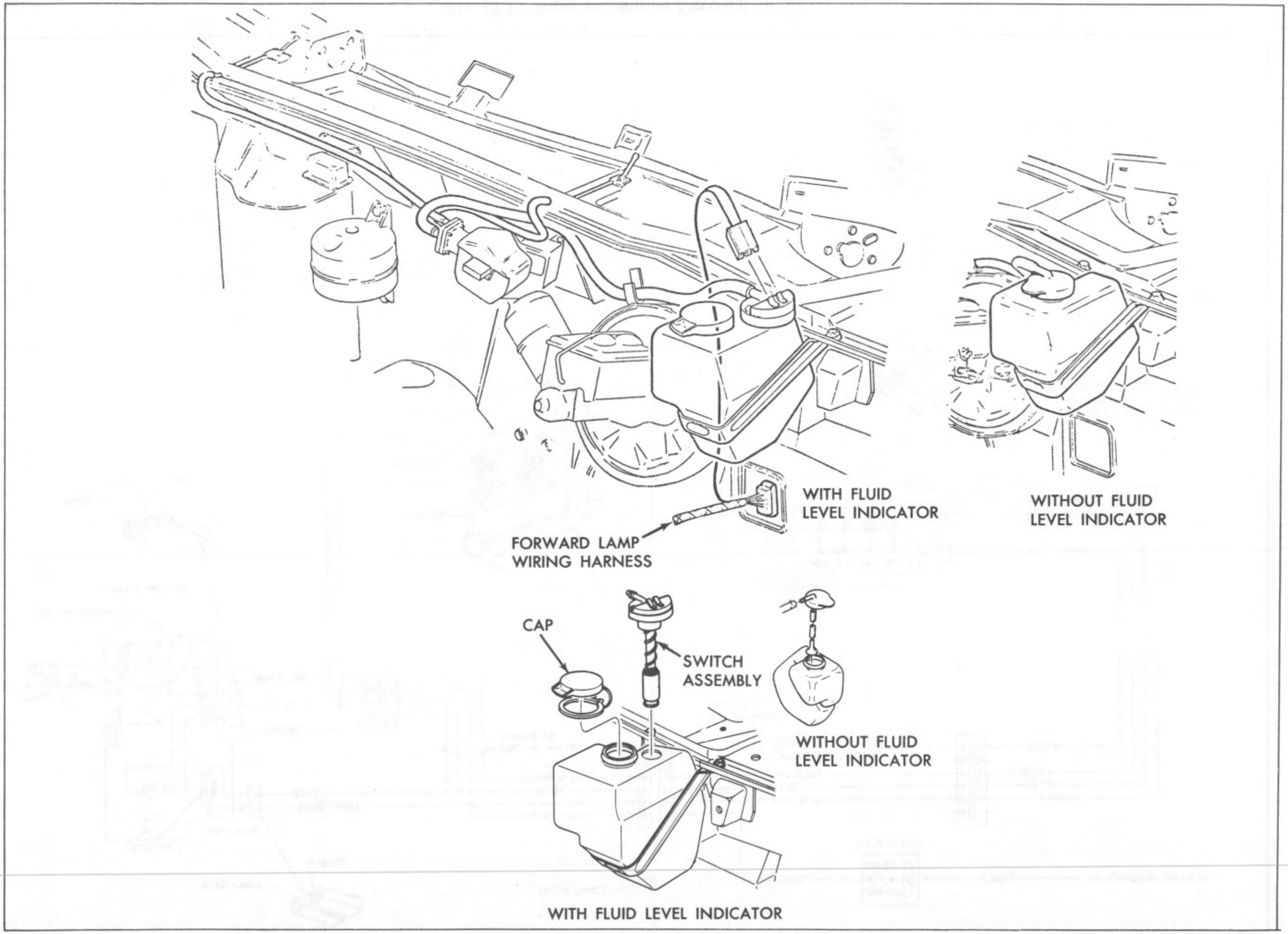


Fig. 12-18 Windshield Washer Components

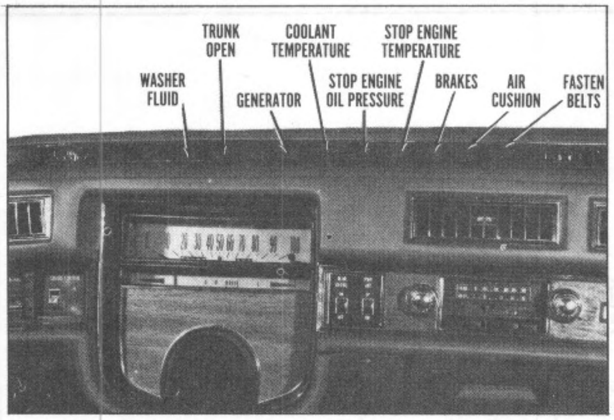


Fig. 12-19 Instrument Panel Warning Lights

Ignition Switch

The starter switch is combined with the steering column and shift lever lock, located on the right side of the steering column below the steering wheel, and is mechanically connected to the ignition switch located on the steering column jacket below the instrument panel. Fig. 12-20.

The engine is started by turning the key clockwise against spring tension to energize the starter solenoid. When the engine starts, releasing the key permits it to return to the Run position. All accessories (except Twilight Sentinel) are disconnected in the Start position.

The ignition lock has five key positions – Accessory – Lock – Off – Run – and Start. The Lock position is clearly marked on the left side of the lock cylinder and is coordinated with the pointer on the ignition knob. The transmission shift lever must be in Park position and the ignition knob in Lock position before the key can be inserted or removed. This locks the steering wheel and transmission shift lever as well as the ignition system.

The Off position allows the engine to be shut off without locking the steering wheel or transmission shift lever, so that the car can be steered or towed in case of any problem requiring turning off the ignition. The Run position completes the ignition circuit and activates all instruments and accessories.

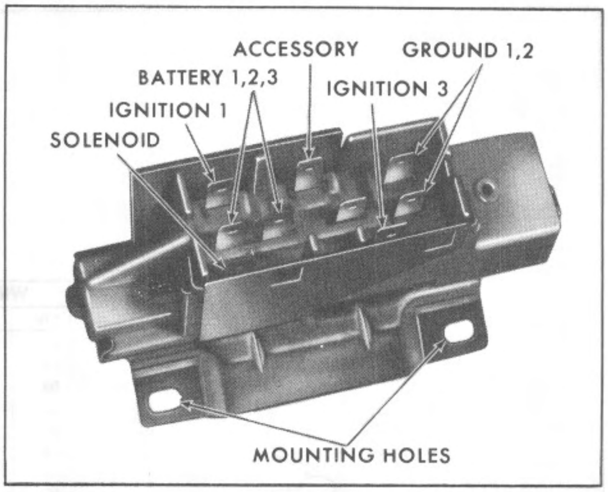


Fig. 12-20 Ignition Switch

The Accessory position allows the use of accessories with the ignition off.

The switch also features a buzzer system to warn the driver to remove the key from the lock. If the driver's door is opened with the key in the lock and the switch in the Off, Lock, or Accessory position, a relay buzzes and the Engine Temperature Warning light is illuminated as a reminder that the key has not been removed from the lock.

Electrical Accessory Installation

When installing additional electrical equipment, such as Rear Window De-Fogger or Twilight Sentinel, connect this equipment to the proper terminals in the wiring harness or the accessory terminal on the fuse panel in accordance with the instructions provided with the accessory. Care should be exercised in installing accessories other than those that are Cadillac designed to avoid overloading the electrical system.

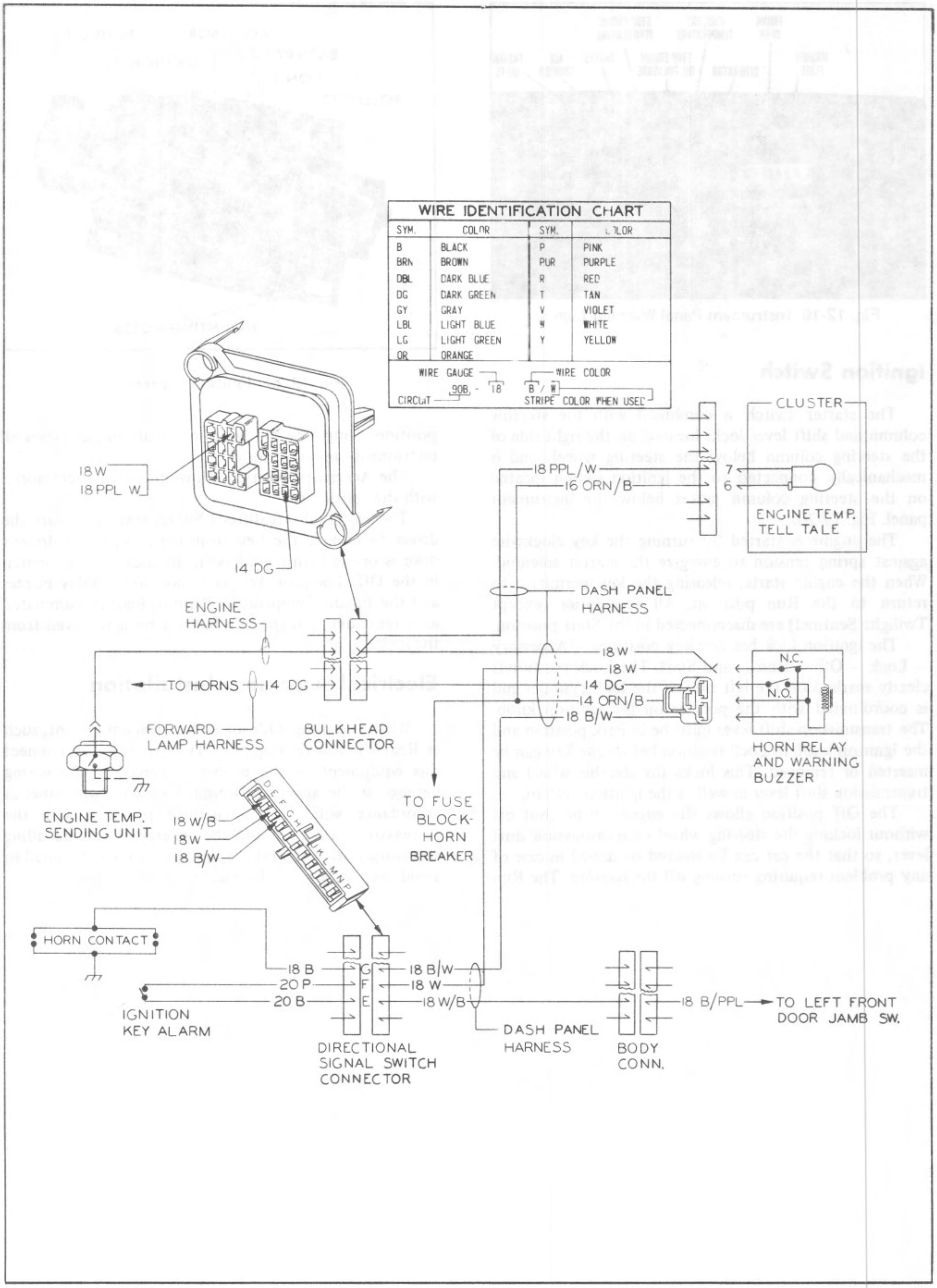


Fig. 12-21 Engine Temperature Warning System

ELECTRICAL INSTRUMENTS DIAGNOSIS

17. Fuel Gage

The fuel gage and bulb are fed through a separate connector on the rear of the gage rather than through the printed circuit as in previous years. The connector is serviced after removing the instrument panel pad (Note 32) and positioning the L.H. A/C hose out of the way.

When checking the fuel gage circuit, first determine whether the tank unit, wiring, or fuel gage is faulty.

Although the following conditions may occur in a fuel indication system, they should not be considered as failure:

1. Pointer does not return to "E" when the ignition is turned off.
2. Pointer does not move below "F" after fill-up until considerable distance has been driven.
3. Gage does not always register full after fill-up. (This may result from fueling when the vehicle is not level or when the fuel is stopped by the first automatic shutoff of the pump nozzle. The last few gallons must be slowly hand-delivered to the tank.)
4. Tank is not empty when the pointer is on "E". (The tank contains approximately 1-1/2 gallons reserve by design when the gage reads empty.)

The following checks of the fuel indication system will determine quickly whether incorrect fuel gage readings are the result of an improper operating fuel gage, fuel tank sending unit, or circuit wiring.

(NOTE: One important feature of the following procedures, is the absence of any checks that would place battery current in the system by use of "hot" jumper wires.)

a. Fuel Gage Diagnosis

1. Locate fuel tank sending unit connector (18-tan wire) in trunk at right side of lock mechanism and disconnect from license plate side. With a jumper wire, connect a known good float in body side of connector, grounding float unit to chassis. Slowly move float arm from full to empty position. If instrument panel gage follows float, proceed to step 4.
2. If gage on instrument panel does not follow, disconnect known good float and reconnect trunk connector. Inspect circuit wiring between instrument panel gage and trunk connector for damage. Check for electrical continuity at the tan wire in:
   a. Connector in left rear quarter trunk area.
   b. Body wiring connector to fuse block.
   c. Chassis harness connector to fuel gage.
3. If all connections are sound and no wire damage exists, replace the instrument panel fuel gage. Check system for proper operation after replacing gage.
4. If fuel gage operates correctly in step 1, failure is between trunk connector and tank sending unit ground. Examine trunk connector terminal and clean if required. Also inspect ground wire (18 black) for good connection on chassis; if loose or rusted, clean and reinstall.
5. If problem still exists, fuel tank sending unit must be inspected. Tank must now be lowered.
6. After lowering tank, check both feed wire (18 tan) and ground wire (18 black) for loose connections and continuity. If rusted, clean and reinstall; if open, repair.
7. Remove sending unit from tank, reconnect feed and ground wires to float unit. If fuel gage follows float arm movement, check baffle in gas tank for improper position, causing interference with float.
8. If fuel gage will not follow float arm movement, replace with new sending unit. Check new unit to see that fuel gage follows float arm movement; reinstall gas tank.

(NOTE: If fuel gage remains pegged in full position, re-check for open in circuit wiring, such as disconnects, insulation in terminal crimps, rusted or loose connections, open wires, and terminals loosely seated or by-passed in connector.

If fuel gage remains pegged in empty position, re-check for grounds in circuit wiring, including pinched wires, damaged wire insulation, and broken wires that touch chassis ground.)

b. Bent Float Arm Check

1. Establish a fixed reference point when checking for a bent float arm by placing a straight edge on surface of cover plate, extending it outward. (Fig. 12-21).
2. With float arm in "Empty" position against stop "A", distance from bottom of float (with float horizontal) to straight edge should be 6-9/16 inches ± 1/16 inch, Fig. 12-21. Bend float arm as needed. Check distance from point "B" to "C", which should be 3-13/16 inches ± 1/32 inch, Fig. 12-21. Bend float arm as needed and recheck distance from bottom of float to straight edge.

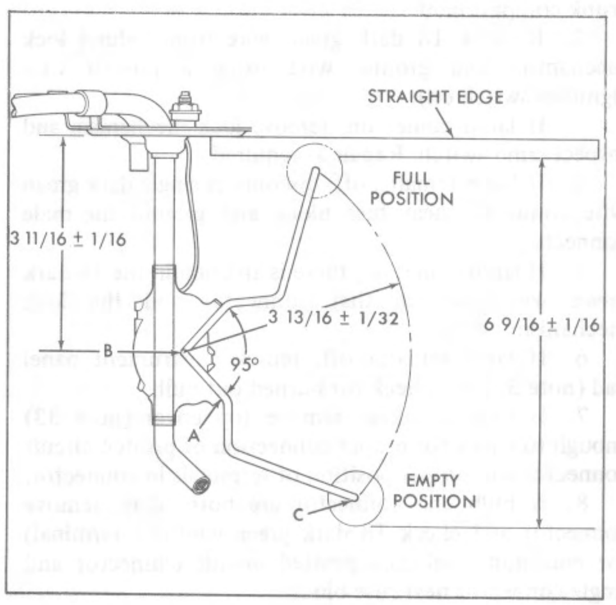


Fig. 12-22 Checking for Bent Float Arm

INDICATOR LAMP DIAGNOSIS

Diagnosis of the generator lamp is found in Section 6, Note 45. Diagnosing the washer fluid lamp is discussed in Section 15, Note 43. While all information on the Air Cushion Restraint system is contained in the ACRS service manual.

Proper operation of the remaining indicator lamp is described in the following notes. A malfunction in only one of the indicator lamps should be diagnosed as described in the appropriate note. More than one inoperative lamp may be caused by a blown fuse or a mispositioned printed circuit connector. These areas should be investigated prior to individual lamp diagnosis.

18. High Beam Indicator Circuit

High beam indicator lamp should be ON whenever the high beam headlights are on.

1. Turn headlights ON. On cars equipped with Guide-Matic, rotate sensitivity control to OFF. Switch to high beam with dimmer switch.

2. If high beams come ON but indicator lamp does not glow, either bulb is burned out, connector is off at instrument cluster printed circuit, 18 light green wire between bulk head connector ("DU") and cluster connector is open or printed circuit is open.

3. If neither high beams nor indicator lamp come on, dimmer switch is malfunctioning or Guide-Matic is inoperative. Refer to Section 15 for Guide-Matic diagnosis.

19. Trunk Lid Warning Lamp ("Trunk Open")

The "trunk open" warning light should glow (amber) with the trunk lid open and the ignition switch in the "ON" position.

a. Trunk Lid Open - Lamp Off

1. Remove cover panel from lock mechanism in trunk compartment.

2. Remove 18 dark green wire from behind lock mechanism and ground wire using a jumper wire (ignition switch on).

3. If lamp comes on, remove lock mechanism and inspect jamb switch. Repair as required.

4. If lamp remains off, disconnect single dark green wire connector near fuse block and ground the male connector.

5. If lamp comes on, there is an open in the 18 dark green wire between that connector and the lock mechanism.

6. If lamp remains off, remove instrument panel pad (note 32) and check for burned out bulb.

7. If bulb is okay, remove top cover (note 33) enough to check for proper connection of printed circuit connector and proper position of terminals in connector.

8. If bulb and connector are both okay, remove connector and check 18 dark green wire (#1 terminal) for continuity between printed circuit connector and single connector near fuse block.

9. If wire is continuous, replace instrument cluster printed circuit.

b. Trunk Lid Closed - Lamp On

1. Open trunk lid and short across latch mechanism to move lock to closed position.

2. Turn ignition switch on. Remove cover panel from lock mechanism and remove 18 dark green wire from behind lock mechanism.

3. If lamp goes off, remove lock mechanism and inspect jamb switch. Repair as required.

4. If lamp remains on, disconnect single dark green connector near fuse block.

5. If lamp goes off, the 18 dark green wire is grounded between the connector and the lock mechanism.

6. If lamp remains on, remove instrument panel pad (note 32) and partially remove top cover (note 33) until printed circuit connector may be inspected for proper connection.

7. If connector is okay, remove connector and check the 18 dark green wire (#1 terminal) for a grounded condition between printed circuit connector and single connector near fuse block.

8. If wire checks okay, replace printed circuit.

20. Brake Combination Valve ("Brakes")

The "brakes" warning lamp should glow (red) during engine cranking and be off at all other times.

a. Lamp Off During Cranking

1. Check for blown "gages-trans" fuse.

2. Turn ignition switch on. Remove 18 black wire from brake combination valve and ground wire. If lamp comes on, proceed to step 7.

3. If lamp remains off, remove instrument panel pad (note 32) and check for burned out indicator bulb.

4. If bulb is okay, partially remove instrument panel cover and inspect printed circuit connector.

5. If bulb and connector are okay, remove printed circuit connector and check the 18 tan wire (terminal #9) for continuity between the connector and the brake combination valve wire.

6. If wire is continuous, replace printed circuit.

7. If lamp comes on as a result of grounding the combination valve wire (Step 1), remove four screws securing steering column to mounting bracket and allow column to drop until access to ignition switch is gained.

8. Ground the 18 tan/white wire at the ignition switch (ignition switch on).

9. If lamp comes on, replace ignition switch.

10. If lamp remains off, the 18 tan/white wire between the ignition switch and bulkhead connector is open.

b. Lamp On With Ignition Switch On

1. Disconnect the 18 black wire from the brake combination valve.

2. If lamp goes out, the brake valve or brake system has malfunctioned.

3. If lamp remains on, leave 18 black wire disconnected at combination valve and remove four screws securing steering column to bracket allowing column to drop for access to ignition switch.

4. Disconnect multiple connector at ignition switch.

5. If lamp goes out, replace ignition switch.

6. If lamp remains on, remove instrument panel pad (note 32) and partially remove top cover (note 33). Disconnect the printed circuit connector and check the following wires for a ground condition:

a. 18 black wire between bulk head connector and brake combination valve.

b. 18 tan wire between printed circuit connector (terminal #9) and the 18 tan/white wire at the ignition switch.

7. If both wires check okay, replace printed circuit.

21. Oil Pressure Indicator Circuit ("Stop Engine Oil Pressure")

The oil pressure indicator light is connected in a circuit with the ignition switch and a pressure operated switch threaded into the oil header galley at rear of engine. Indicator light warns driver when oil pressure is below 4 pounds ± 1-1/2 pounds.

The lamp should glow (red) when the ignition switch is on but the engine is not running. The lamp should go out immediately after the engine is started and remain out during engine operation.

a. Ignition On - Lamp Off - Engine Not Running

1. Check for blown "gages-trans" fuse.

2. Disconnect 18 dark blue wire at oil pressure switch and ground wire using jumper wire. If lamp glows, oil pressure switch is open and should be replaced.

(NOTE: Sealing compound on threads of switch may cause this condition and should never be used.)

3. If lamp remains off, remove instrument panel pad (note 32) and check for burned out indicator bulb.

4. If bulb is okay, partially remove top cover (note 33) until printed circuit connector may be inspected for proper connection.

5. If connector is okay, remove connector and check the 18 dark blue wire (terminal #5) for continuity between connector and oil pressure switch.

6. If wire has continuity, replace printed circuit.

7. If an open condition is indicated by the continuity, check inspect engine harness connector. Repair wire as required.

b. Engine Running - Lamp On

1. Disconnect 18 dark blue wire at oil pressure switch.

2. If indicator lamp goes off, the oil pressure switch is shorted or the engine has low oil pressure. If a new switch does not provide proper indicator lamp operation, remove switch and test engine oil pressure using a reliable pressure gage.

3. If lamp remains on, remove instrument panel pad (note 32) and partially remove top cover (note 33) until printed circuit connector is serviceable.

4. Inspect connector for proper connection.

5. If connector is okay, remove connector and test 18 dark blue wire (terminal #5) for continuity between printed circuit connector and oil pressure switch connector.

6. If wire is okay, replace printed circuit.

22. Water Temperature Indicator Circuit ("Coolant Temperature")

The amber "coolant temperature" lamp should glow during engine cranking and whenever coolant temperature is excessive.

a. Lamp Off During Cranking

1. Check for blown "gages-trans" fuse.

2. Turn ignition switch on. Disconnect 18 dark green wire to temperature sender at connector near A/C compressor and ground wire from bulk head connector.

3. If lamp comes on, replace temperature sender.

4. If lamp remains off, remove instrument panel pad (note 32) and inspect for burned out lamp.

5. If lamp is okay, partially remove top cover (note 33) and inspect printed circuit connector.

6. If lamp and connector are okay, remove four screws securing steering column to bracket and allow column to drop for access to ignition switch.

7. Ground the 18 dark green wire at the ignition switch.

8. If lamp comes on, replace ignition switch.

9. If lamp remains off, check the following wires for continuity:

a. 18 dark green wire between printed circuit connector (terminal #4) and ignition switch.

b. 18 dark green wire between printed circuit connector (terminal #4) and temperature sender connector.

10. If wires are continuous, replace printed circuit.

b. Lamp Is On When Ignition Is On

1. Disconnect 18 dark green wire to temperature sender at connector near A/C compressor.

2. If lamp goes out, replace temperature sender.

3. If lamp remains on, remove four screws securing steering column to bracket and allow column to drop for access to ignition switch.

4. Disconnect electrical connector from ignition switch.

5. If lamp goes out, replace ignition switch.

6. If lamp remains on, remove instrument panel pad (note 32) and partially remove top cover (note 33) for access to printed circuit connector.

7. Disconnect printed circuit connector and check the following wires for a grounded condition:

a. 18 dark green wire between printed circuit connector (terminal #4) and temperature sender connector.

b. 18 dark green wire between printed circuit connector (terminal #4) and ignition switch.

8. If wires are okay, replace printed circuit.

23. Seat Belt Warning Light ("Fasten Belts")

The red "fasten belts" light should come on only when the ignition switch is ON and seat belts are disconnected with the transmission in a forward gear.

If both light and buzzer are inoperative, diagnose the circuit as described under seat belt/starter interlock system on page 1 - 7. If buzzer operates normally but light does not, proceed as follows:

a. Light Does Not Come On

1. Remove instrument panel pad (note 32) and check for burned out bulb.

2. If bulb is okay, partially remove top cover (note 33) until access to printed circuit connector is obtained.

3. Inspect printed circuit connector for proper connection.

4. If properly connected, remove connector from printed circuit and check for voltage at terminal #13 (yellow/black wire) with ignition on, seat belt unfastened and transmission in a forward gear.

5. If voltage is not available, the yellow/black wire is open between the buzzer and the #13 terminal of the printed circuit connector.

6. If voltage is available, check the 18 black wire (terminal #12) for continuity between the connector and the buzzer.

7. If wire is con•inuous, replace printed circuit.

b. Light Will Not Go Out

1. Remove instrument panel pad (note 32) and partially remove top cover (note 33). Remove printed circuit connector.

2. Check 18 black wire (terminal #12) for grounded condition.

3. If wire is okay, replace printed circuit.

24. Engine Temperature Indicator Circuit ("Stop Engine Temperature")

In addition to indicating an engine overheating condition, the red "stop engine temperature" warning lamp should come on whenever the ignition key warning buzzer sounds (key in lock, ignition off and driver's door open).

a. Lamp Fails To Come On

1. Disconnect the 18 light green wire from the metal temperature switch at the rear of the left cylinder head and ground the wire.

2. If lamp comes on and buzzer sounds, replace temperature switch.

3. If lamp remains off, check for an open horn circuit breaker.

4. If circuit breaker is okay, remove instrument panel pad (note 32) and check for burned out bulb.

5. If bulb is okay, partially remove top cover and inspect printed circuit connector.

6. If bulb and connector are okay, remove printed circuit connector and check for continuity between terminal #6 and temperature switch.

7. If continuity is indicated, check for voltage at the #7 terminal of the printed circuit connector (16 orange/black wire).

8. If voltage is indicated, there is an open in the 18 purple/white wire between the #6 printed circuit connector and the "DX" terminal and the temperature switch.

9. If voltage is not indicated, there is an open in the 16 orange/black wire between the connector and the fuse block.

b. Lamp Fails To Go Out

1. Disconnect 18 light green wire at metal temperature switch at rear of left cylinder head.

2. If lamp goes out, replace temperature switch.

3. If lamp remains on, the 18 light green wire between the temperature switch and the "DX" terminal of the bulkhead connector is grounded or the 18 purple/white wire between the bulkhead connector "DX" terminal and terminal #6 of the printed circuit connector is grounded.

25. Horn Operation and Testing

Conditions that may affect horn performance and procedures for checking these conditions are listed below:

1. Actuate horn by depressing the steering wheel pad in any area. Horn should blow. If horn fails to blow, proceed to Step 2.

2. While horn is energized, tap horn lightly. If horn blows, proceed to Step 3. If horn fails to blow, refer to Step 6 of this procedure.

3. Release cushion so that horn will stop blowing.

4. Energize horn again. If horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is necessary.

5. If horn still fails to blow when tapped, turn adjustment screw, Fig. 12-25, one full turn counterclockwise with pliers.

(NOTE: This adjustment is sensitive. Do not turn screw more than one full turn or in wrong direction (clockwise). Misadjustment will require removing horn for adjustment on bench as described in Part d of this Note.)

6. Check horn for normal operation. If still inoperative, inspect circuit breaker to assure power is available, then perform the following checks.

a. Connect a jumper lead to number "3" and number "1" terminals of horn relay. If horn blows,

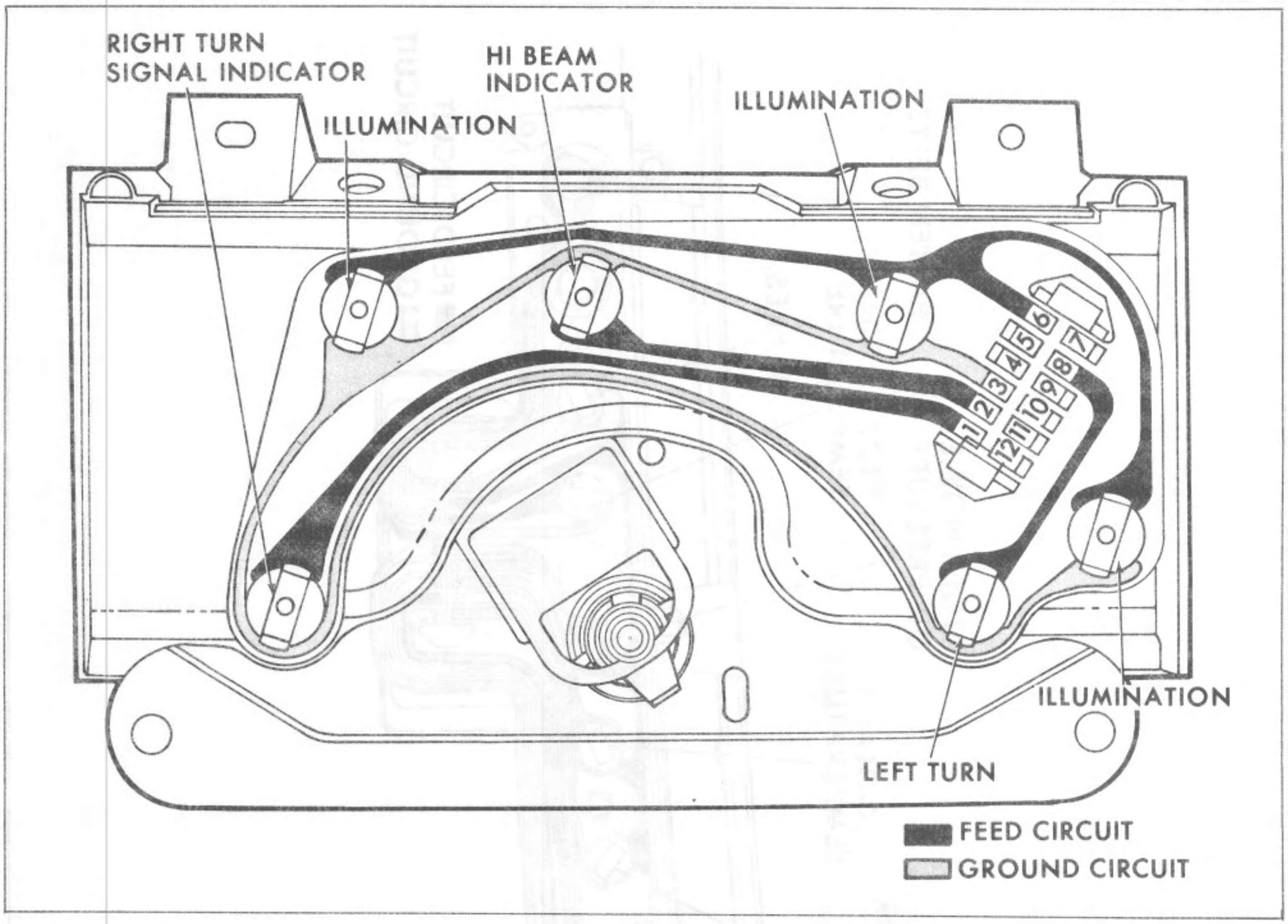


Fig. 12-23 Instrument Cluster Printed Circuit

INSTRUMENT CLUSTER PRINTED CIRCUIT LEGEND

No. and Circuit		Wiring Color Code
1	R.H. Turn Indicator	18 Dark Blue
2	Hi-Beam Indicator	18 Light Green
3	Ground	16 Black
4	Blank	
5	Blank	
6	Illumination	18 Gray
7	Blank	
8	L.H. Turn Indicator	18 Blue with Light Green and Black
9	Blank	
10	Blank	
11	Blank	
12	Blank	

trouble is in relay, steering wheel pad switching or wiring. Remove jumper lead.

b. To determine whether steering wheel pad switches or wiring is at fault, ground number "2" terminal of relay. If horn blows, pad switching or wiring is at fault.

c. Use a jumper from an area cleared of paint on horn bracket to grounded metal on radiator cradle, check for no ground due to corrosion or paint on bolt threads. If horn blows, clean bolt threads and horn bracket surfaces which mate with radiator cradle.

d. If horn does not blow and wiring between battery and relay is not defective, connect a voltmeter between terminal on the horn and a paint free area on

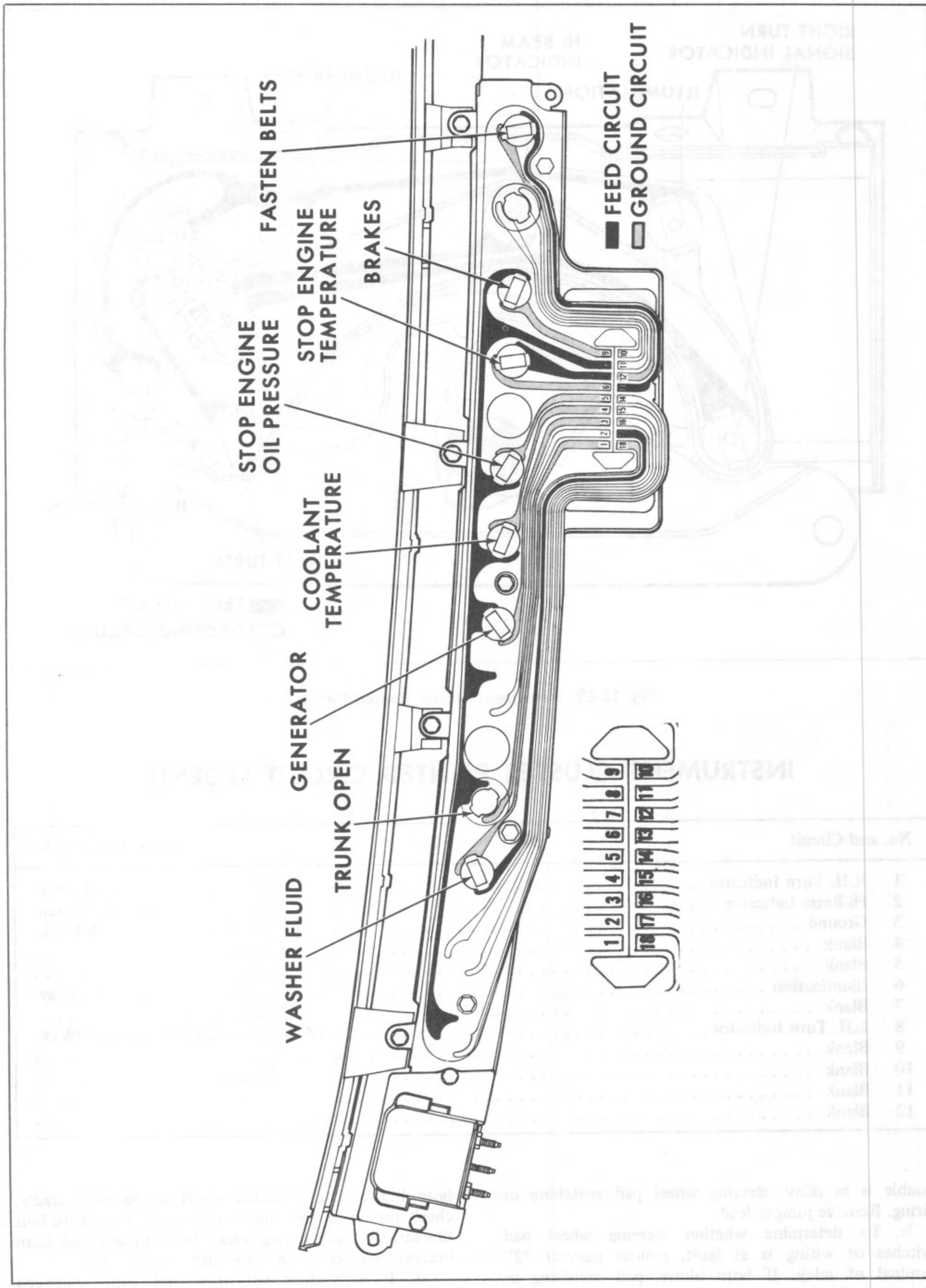


Fig. 12-24 Warning Lamp Cluster Printed Circuit

WARNING LAMP CLUSTER PRINTED CIRCUIT LEGEND

No. and Circuit		Wiring Color Code
1	Trunk Lid Open (Ground)	18 Dark Green
2	Blank	
3	Generator	16 Brown
4	Coolant Temperature (Ground)	18 Dark Green
5	Oil Pressure (Ground)	18 Dark Blue
6	Engine Metal Temperature (Ground)	18 Purple with White
7	Engine Metal Temperature (Feed)	16 Orange with Black
8	Feed for Circuits 1-3-4-5-9.	18 Pink
9	Brakes (Ground)	18 Tan
10	Blank	
11	Blank	
12	Fasten Belts (Ground)	18 Black
13	Fasten Belts (Feed)	18 Yellow with Black
14	Blank	
15	Blank	
16	Blank	
17	Washer Fluid (Feed)	18 Blue with Light Green
18	Washer Fluid (Ground)	18 Black with White

the radiator cradle. Connect a jumper lead to number "3" and number "1" terminals of relay and note voltmeter reading.

e. If no voltmeter reading is obtained, wiring between relay and horn is open.

f. If voltmeter reading is less than 7.0 volts, trouble is due to high resistance connections in battery connection or wiring.

g. If voltmeter reading is above 7.0 volts, trouble is due to a faulty horn. In this case, test horn for current draw.

7. If no trouble is located during these checks and horn is still inoperative, remove horn for a bench check.

a. Horn Tone Poor

1. Harsh tone – caused by loose bolts in sheet metal mounting area.
2. Low pitch road – sounds like "moo-ing" and is caused by too high a current. Horn needs adjusting.
3. Weak tone – caused by too low a current. Horn needs adjusting.
4. Weak strained tone – foreign body in horn trumpet that should be shaken out or removed.
5. Harsh vibration – caused by horn touching sheet metal. Bracket should be bent to give horn clearance and freedom from interference.

b. Horn Blows Constantly

1. This can be caused by sticking horn contacts in the relay, or horn pad.
2. Horn relay may be energized by grounded or shorted wiring.

(NOTE: Burned open windings on most horns are caused by one of the above malfunctions. Before horns with open windings are replaced by new horns, make sure that none of the above conditions exist, or the horn windings will again burn open.)

c. Bench Checks

1. Measure current draw of horn while horn is operating. Current draw for each horn should be between 4.5 and 5.5 amperes at 11.5 to 12.5 volts.
2. No current may indicate a broken connection or an open circuit due to a broken lead or to overheating. Most horn failures are caused by horns being operated continuously, which develops sufficient heat to melt the wires in the winding, causing an open circuit. Overheating is accompanied by a characteristic odor which indicates that horn should be replaced.
3. No current can also indicate that the contact points are open and a current adjustment is required. Turn adjusting screw counterclockwise.
4. High current, over 20 amperes, indicates an overheated winding or shorted horn which should be replaced.
5. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required by turning the adjustment screw clockwise.

d. Current Adjustment

Turn adjusting screw, Fig. 12-25, counterclockwise to increase current or clockwise to decrease current until specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn screw 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with a punch.

e. Cold Weather Adjustment

If horn fails to blow in cold weather, it is possible that current limit is set too low although still within 4.5 – 5.5 ampere limit (each horn) at 12.0 volts. Turn

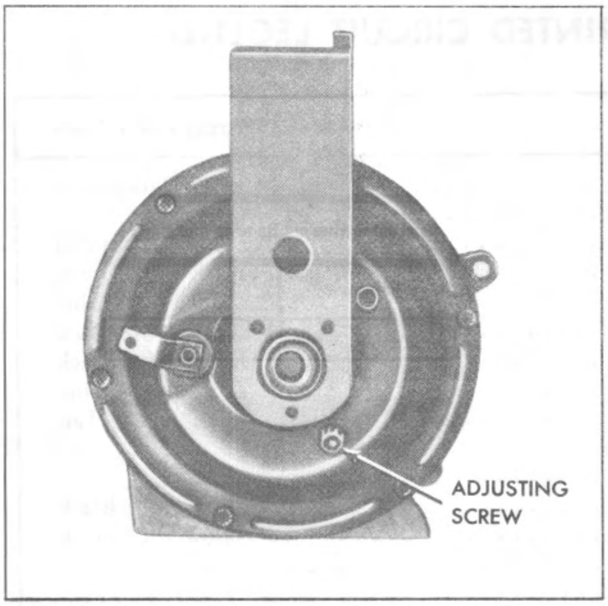


Fig. 12-25 Horn Adjusting Screw

adjusting screw 1/4 turn counterclockwise (90°) to increase draw, Fig. 12-25.

CAUTION: This adjustment should not be made unless horn fails to blow. A current increase on a properly operating horn can result in complete failure of unit.

26. Clock Resetting

The reset knob projects from the upper right hand corner of the clock. To reset, pull reset knob all the way out and turn until desired time is obtained. When resetting, be sure numbers are centered in window. After resetting, push knob all the way in.

The special oils used to lubricate automotive clocks tend to deteriorate with age. If timekeeping characteristics of the clock become erratic, it should be removed and sent to the clock manufacturer's authorized clock repair station for cleaning and re-oiling. Cleaning and re-oiling is recommended at least once every two years.

SERVICE INFORMATION

27. Turn Signal Switch Replacement—Tilt and Telescope Column

1. Disconnect negative battery cable.
2. Remove steering wheel as described in Section 9, Note 27a.
3. Slide rubber sleeve bumper from steering shaft.
4. Remove plastic retainer, using small screwdriver to disengage tabs on retainer from C-ring.
5. Install spring compressor J-23063 on steering shaft, Fig. 12-26, threading bolt into steering shaft lock hole.

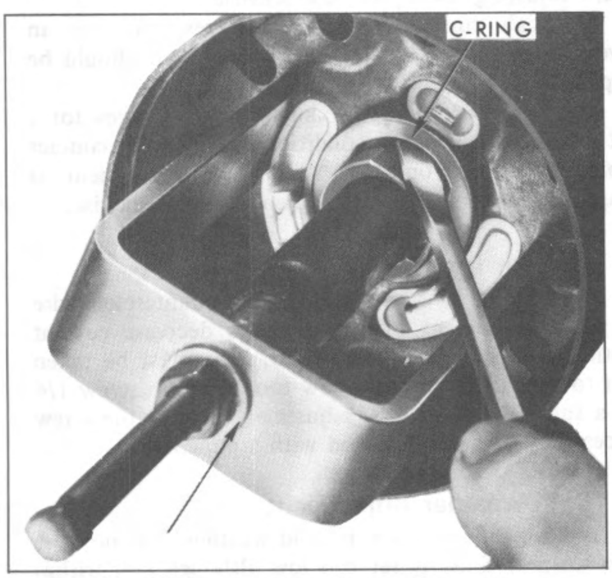


Fig. 12-26 Installing Spring Compressor

(NOTE: When installing spring compressor, pull upper shaft up 1" from bottomed position then turn ignition to Lock to hold shaft in place.)

6. Compress upper steering shaft preload spring and remove C-ring, Fig. 12-26.
7. Remove spring compressor, J-23063, and remove upper steering shaft lock plate, horn contact carrier and upper steering shaft preload spring.
8. Remove steering column lower cover as described in Note 31a.
9. Unscrew turn signal lever and remove lever from column.

(NOTE: On cars equipped with cruise control, perform the following procedure.)

a. Disconnect cruise control wire from car harness near bottom of column.

b. Slide harness protector off of cruise control wire.

c. Wind wire around turn signal lever until lever is disconnected. Do not remove wire from column.

10. Remove two vertical bolts at steering column upper support. Remove shim packs. Maintain shims as a unit, for installation.
11. Remove four screws (2 each side) securing column upper mounting bracket to column and remove bracket.
12. Disconnect turn signal harness from car harness and remove wires from plastic protector.
13. Remove three screws securing turn signal switch to column and pull switch out of position in shift bowl.
14. If switch is known to be bad, cut wires from

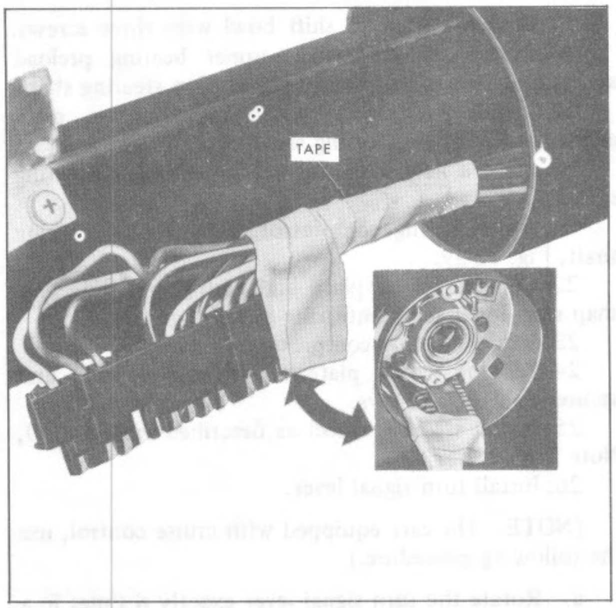


Fig. 12-27 Taping Connector

switch and discard switch. Tape new switch connector to old harness and carefully pull new harness down through column as old harness is removed. Proceed to Step 16.

15. If existing switch is to be reused, wrap a piece of tape around the wire and harness as shown in Fig. 12-27, and carefully pull the harness up through the column.

16. To install switch, tape end of harness as shown in Fig. 12-27 and carefully feed harness down thru column.

17. Secure switch to shift bowl with three screws.

18. Install upper steering shaft preload spring.

19. Install lock plate and carrier assembly.

(NOTE: When installing lock plate and carrier assembly, make sure flat on lower end of steering shaft is pointing up and that the small plastic tab on the carrier is up or nearest the top of the shift bowl. Flat surface of lock plate must be installed facing down (against turn signal switch.)

20. Install spring compressor, J-23063. Compress preload spring and lock plate and install C-ring with wide side toward keyway.

21. Remove spring compressor, J-23063.

22. Install plastic retainer on C-ring.

23. Install rubber sleeve bumper over steering shaft.

24. Install steering wheel as described in Section 9, Note 27 b.

25. Install turn signal lever.

(NOTE: On cars equipped with cruise control, use the following procedure.)

a. Rotate the turn signal lever exactly 6 times in a clockwise direction to wind harness tightly around lever.

b. Position lever to switch and screw in. Unwind harness as lever is installed.

26. Remove tape from end of harness and connect switch and cruise control (if equipped) to car harness.

27. Cover both harnesses with plastic protector and position to column. Turn signal connector slides on tabs of column.

28. Position steering column upper bracket over turn signal switch harness plastic protector and install four screws holding bracket to column (2 each side). Tighten screws to 20 foot-pounds.

29. Loosely install two vertical mounting bracket screws. Install shims in same quantity and location as found when bracket was removed.

30. Align steering column as described in Section 9, Note 28b, Steps 7 thru 14. Torque vertical screws to 20 foot-pounds.

31. Install steering column lower cover as described in Note 31b.

28. Turn Signal Switch Replacement—Standard Column

If car is equipped with Air Cushion Restraint System, refer to 1974 ACRS service manual for procedures specific to the ACRS steering column.

1. Disconnect negative battery cable.
2. Remove steering wheel as described in Section 9, Note 27a.
3. Remove three screws securing lock plate cover assembly to lock plate lock plate and remove cover assembly, Fig. 12-28.
4. Install spring compressor J-23131, on steering shaft, Fig. 12-29.
5. Compress lock plate and spring. Remove snap ring and discard, Fig. 12-29.

CAUTION: Shaft could slide out of bottom of column when snap ring is removed, causing damage to shaft.

6. Remove lock plate by sliding up and off upper shaft.
7. Slide turn signal cancelling cam, upper bearing preload spring and thrust washer off upper steering shaft.

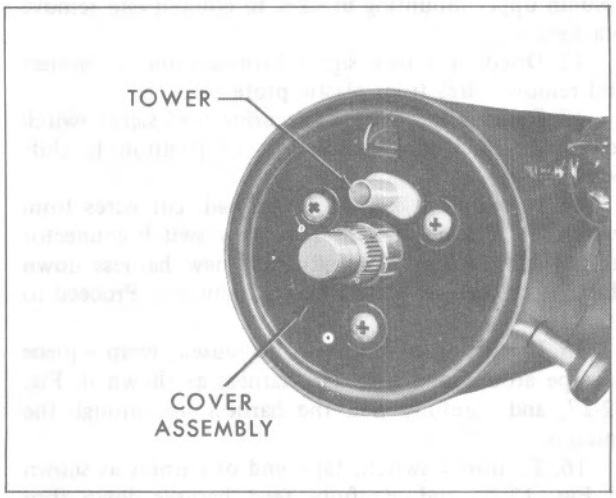


Fig. 12-28 Cover Plate and Mounting Screws

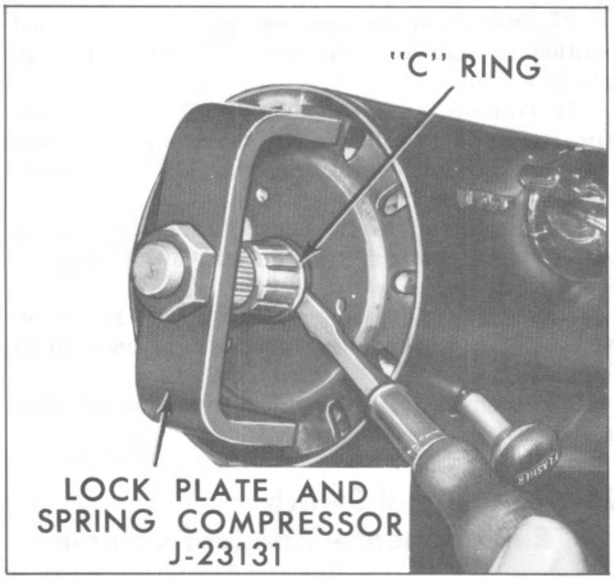


Fig. 12-29 Removing and Installing C-Ring

CAUTION: Care should be taken at this point as steering shaft is free to move and could slide out of column.

8. Remove steering column lower cover as described in Note 31a.

9. Unscrew turn signal lever and remove lever from column.

(NOTE: On cars equipped with cruise control, perform the following procedure.)

a. Disconnect cruise control wire from car harness near bottom of column.

b. Slide harness protector off of cruise control wire.

c. Wind wire around turn signal lever until lever is disconnected. Do not remove wire from column.

10. Remove two vertical bolts at steering column upper support. Remove shim packs, maintain shims as a unit, for installation.

11. Remove four screws (2 each side) securing column upper mounting bracket to column and remove bracket.

12. Disconnect turn signal harness from car harness and remove wires from plastic protector.

13. Remove three screws securing turn signal switch to column and pull switch out of position in shift bowl.

14. If switch is known to be bad, cut wires from switch and discard switch. Tape new switch connector to old harness and carefully pull new harness down through column as old harness is removed. Proceed to Step 16.

15. If existing switch is to be reused, wrap a piece of tape around the wire and harness as shown in Fig. 12-27, and carefully pull the harness up through the column.

16. To install switch, tape end of harness as shown in Fig. 12-27 and carefully feed harness down thru column.

17. Secure switch to shift bowl with three screws.

18. Install thrust washer, upper bearing preload spring and turn signal cancelling cam on steering shaft.

19. Install lock plate with large flat on plate aligned with flat on steering shaft.

20. Place a new snap ring on upper end of steering shaft.

21. Install spring compressor, J-23131, on steering shaft, Fig. 12-29.

22. Compress lock plate and spring and slide new snap ring down shaft until ring locks in groove.

23. Remove spring compressor, J-23131.

24. Position cover plate to steering column and secure with three screws.

25. Install steering wheel as described in Section 9, Note 27b.

26. Install turn signal lever.

(NOTE: On cars equipped with cruise control, use the following procedure.)

a. Rotate the turn signal lever exactly 6 times in a clockwise direction to wind harness tightly around lever.

b. Position lever to switch and screw in. Unwind harness as lever is installed.

27. Remove tape from end of harness and connect switch and cruise control (if equipped) to car harness.

28. Cover both harnesses with plastic protector and position to column. Turn signal connector slides on tabs of column.

29. Position steering column upper bracket over turn signal switch harness plastic protector and install four screws holding bracket to column (2 each side) Tighten screws to 20 foot-pounds.

30. Loosely install two vertical mounting bracket screws. Install shims in same quantity and location as found when bracket was removed.

31. Align steering column as described in Section 9, Note 28b, Steps 7 thru 14. Torque vertical screws to 20 foot-pounds.

32. Install steering column lower cover as described in Note 31b.

29. Back-Up Light Switch

The back-up light switch, and parking brake vacuum release valve are combined into one unit mounted on the steering column under the instrument panel.

a. Removal

1. Place transmission shift lever in NEUTRAL position.

2. Remove screw in clamp and carefully remove switch and clamp from steering column, being careful not to disturb position of contact carrier.

3. Mark position of contact carrier.

4. Mark top vacuum hose for identification and remove hoses.

5. Disconnect three wiring connectors from switch.

b. Installation

1. Place transmission shift lever in NEUTRAL detent.

2. Connect three wiring connectors to switch.

3. Move contact carrier on switch assembly to neutral position as marked during removal. If necessary to install a new switch, the switch will be secured in neutral by a shear pin. Do not break pin.

4. Install switch assembly on steering column, aligning contact carrier blade with slot in shift tube. With switch tight against column, slide switch down column until bosses on casting rest on bottom edge of slot in outer jacket. Bosses extend below the mounting surface.

5. Place clamp on switch and install screw to tighten clamp, making sure that shift lever is in NEUTRAL detent while this operation is performed.

6. Connect vacuum hoses to switch as marked during removal.

7. Switch should now be properly adjusted. If new switch was installed, a slightly greater effort to position the shift lever in any position besides neutral will be necessary, because it will be necessary to break the shear pin.

8. Check to make sure that back-up lights come on in REVERSE and that fasten seat belts light comes on in DRIVE (parking brake must also release in DRIVE).

GENERAL INFORMATION

(NOTE: Service procedures for component parts of the optional Air Cushion Restraint System are described in detail in the Air Cushion Restraint System Manual. Service procedures that are different due to the Air Cushion Restraint System option are described in the latter part of this section.)

The instrument panel for all cars, Fig. 12-30, is completely new. The five major parts of the panel are the top cover, instrument panel pad, horizontal support, lower instrument panel cover and lower steering column cover. This section includes procedures for the removal and installation of all components that are a part of or attached to the above major parts. Included are the following:

Top Cover – Radio speakers, speaker and defroster grilles, twilight sentinel photocell, climate control sensor, fuel gage, digital clock, tell tale housing assembly and extensions.

Instrument Panel Pad – Windshield wiper switch, climate control outlets, doors and ducts.

Horizontal Support – Cluster assembly and bezel, left and right inserts and appliques, headlamp or guidematic or twilight sentinel switch, air conditioning control, cruise control switch, accessory switches (sunroof, power antenna, rear window defogger and convertible top), radio receiver, track master controller, theft deterent controller, rear window defogger relay, control for right hand mirror and map light.

Lower Instrument Panel Cover – Ashtray and lighter, glove box assembly, power trunk release switch and theft deterrent switch.

Lower Steering Column Cover (Reinforcement) – Twilight sentinel amplifier and turn signal flasher.

The procedures for actual disassembly, assembly testing, or adjustment of the various components are covered in the specific sections of this manual where they apply. Wiring diagrams are located on the back cover gatefold.

The instrument panel utilizes printed circuits in both the cluster and tell tale assemblies. They are connected to the wiring harness through multiple terminal connectors which are plugged into the back of the cluster and underside of the tell tale assembly. The printed circuit permits removal of all bulbs and sockets without any wire or terminal removal.

30. Climate Control Air Outlet Grilles (Fig. 12-31)

a. Removal

1. Using Remover and Installer Tool, J-21612, compress release tabs.
2. Rotate grille upward and remove grille.

b. Installation

1. Using Remover and Installer Tool, J-21612, compress release tabs and position grille as shown in Fig. 12-31.
2. Remove tool and position grille so that tabs snap into retaining holes.

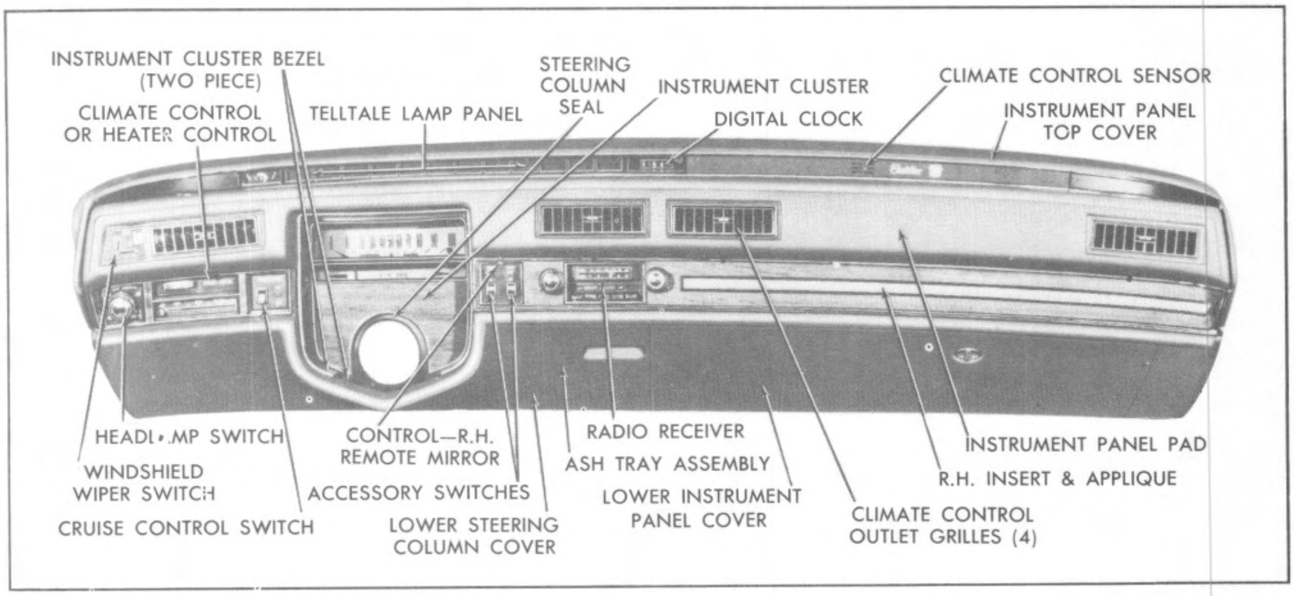


Fig. 12-30 Instrument Panel Assembly

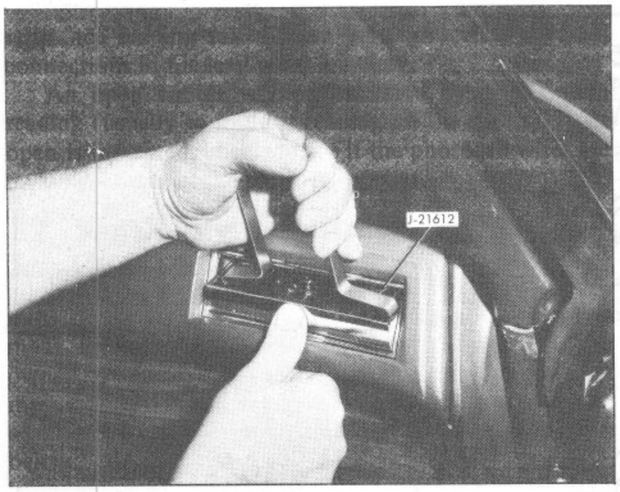


Fig. 12-31 Removing Climate Control Air Outlet Grille

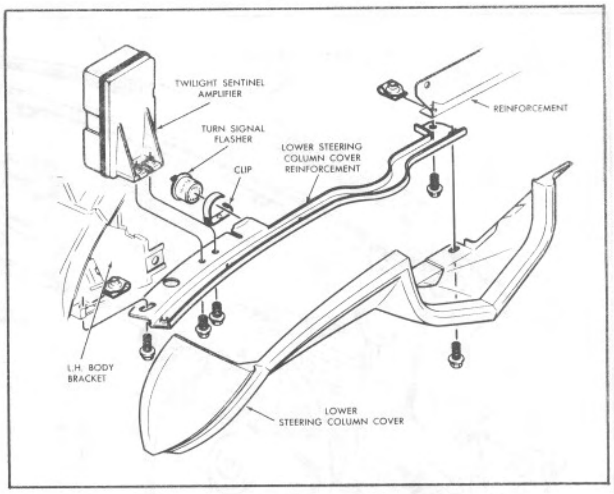


Fig. 12-32 Lower Steering Column Cover Disassembled

31. Lower Steering Column Cover (Fig. 12-32)

a. Removal

1. Remove four screws securing lower cover to lower steering column cover reinforcement.
2. Remove four screws securing lower cover to instrument panel horizontal support.
3. Remove lower cover.

b. Installation

1. Place lower cover in position and install four screws securing cover to instrument panel horizontal support.
2. Install four screws securing lower cover to lower steering column cover reinforcement.

32. Instrument Panel Pad (Fig. 12-33)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control outlet grilles – right, left and right center – as described in Note 30a.
3. Working through outlet openings, remove 3 fasteners securing pad to instrument panel support.
4. Remove screws securing pad to instrument panel horizontal support.

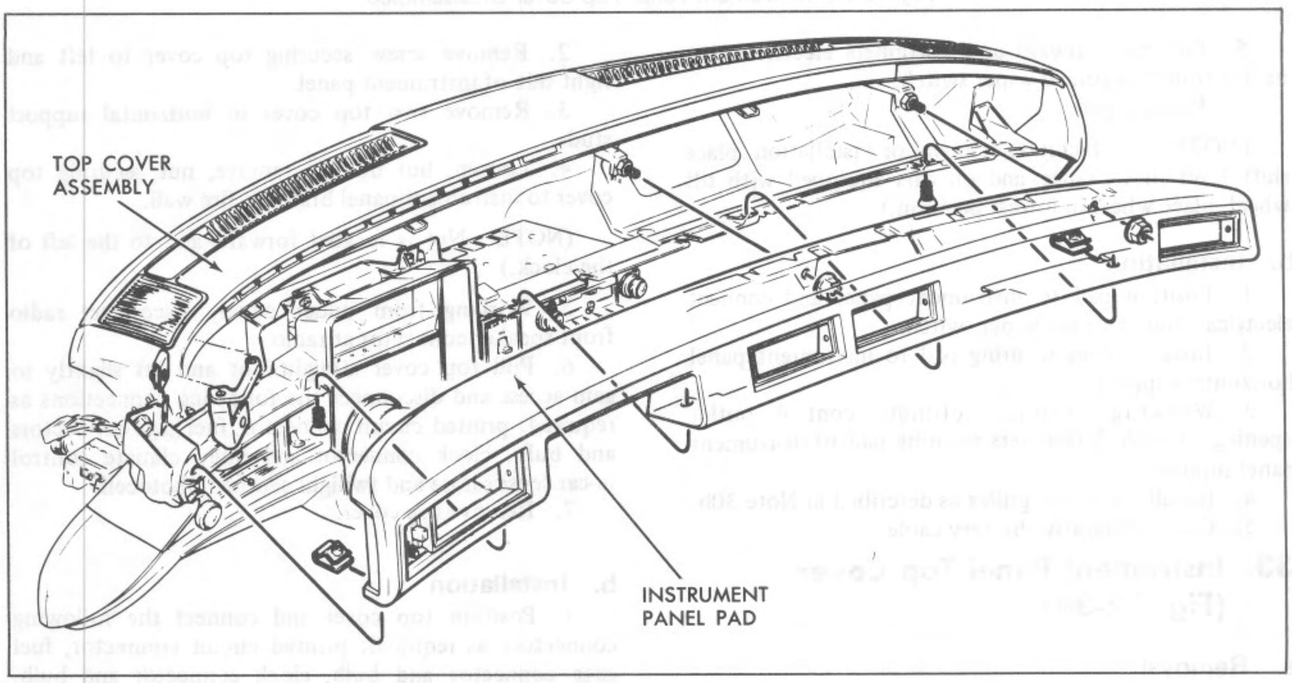


Fig. 12-33 Removing Instrument Panel Pad

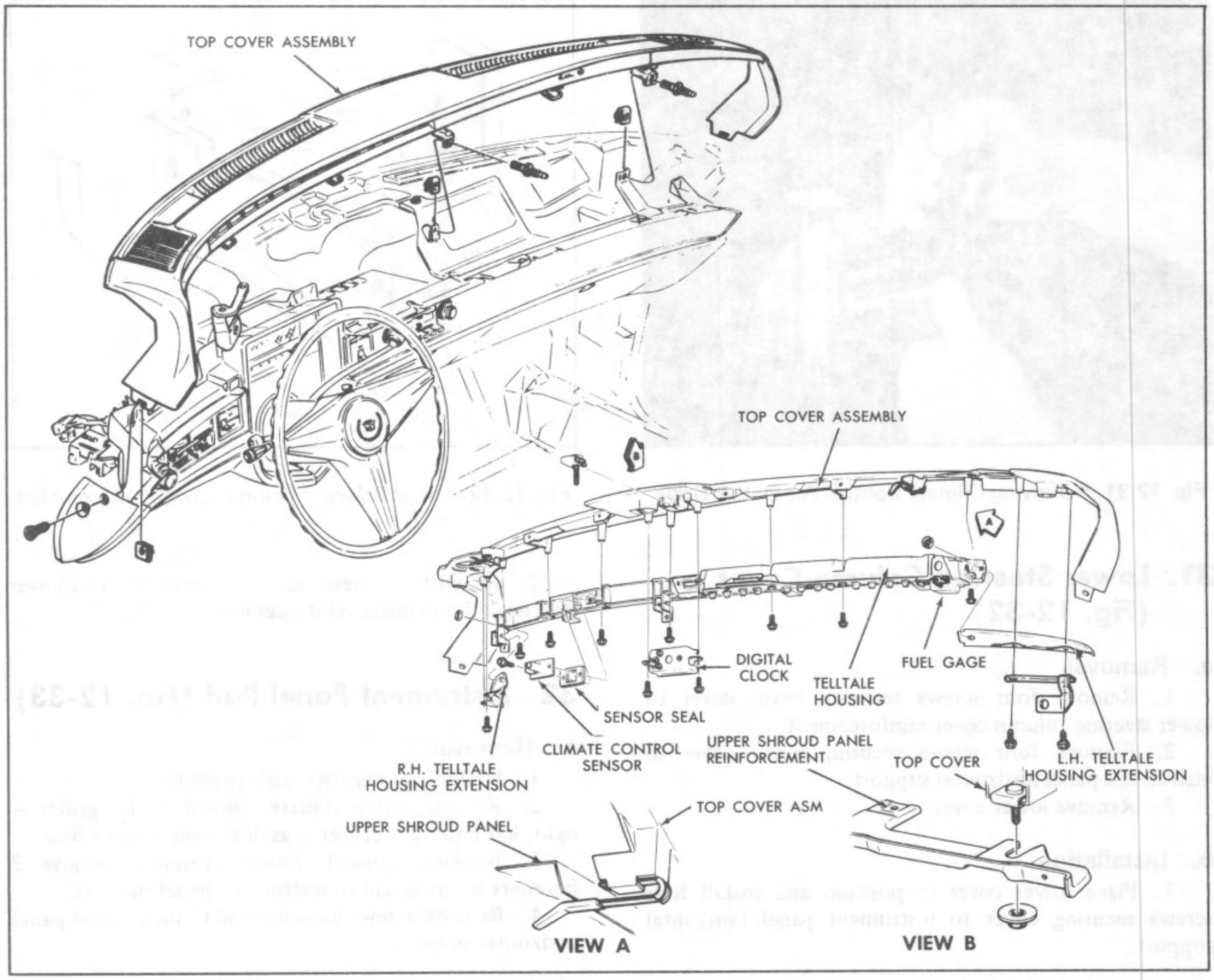


Fig. 12-34 Instrument Panel Top Cover Disassembled

5. Pull pad outward and disconnect electrical connector from windshield wiper switch.

6. Remove pad.

(NOTE: To facilitate removal or installation, place shift lever in lo range and on cars equipped with tilt wheel, place wheel in lowest position.)

b. Installation

1. Position pad to instrument panel and connect electrical connector for wiper switch.
2. Install screws securing pad to instrument panel horizontal support.
3. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.
4. Install air outlet grilles as described in Note 30b.
5. Connect negative battery cable.

33. Instrument Panel Top Cover (Fig. 12-34)

a. Removal

1. Remove instrument panel pad as described in Note 32a.
2. Remove screw securing top cover to left and right side of instrument panel.
3. Remove two top cover to horizontal support studs.
4. Loosen, but do not remove, nut securing top cover to instrument panel brace on fire wall.

(NOTE: Nut is located forward and to the left of the clock.)

5. Working from under panel, disconnect radio front speaker connector at radio.
6. Pull top cover straight out and lift slightly to gain access and disconnect the following connections as required: printed circuit connector, fuel gage connectors and bulb, clock connector and bulb, climate control in-car sensor hose and twilight sentinel photocell.
7. Remove top cover.

b. Installation

1. Position top cover and connect the following connectors as required: printed circuit connector, fuel gage connector and bulb, clock connector and bulb, climate control in-car sensor, and twilight sentinel photocell.

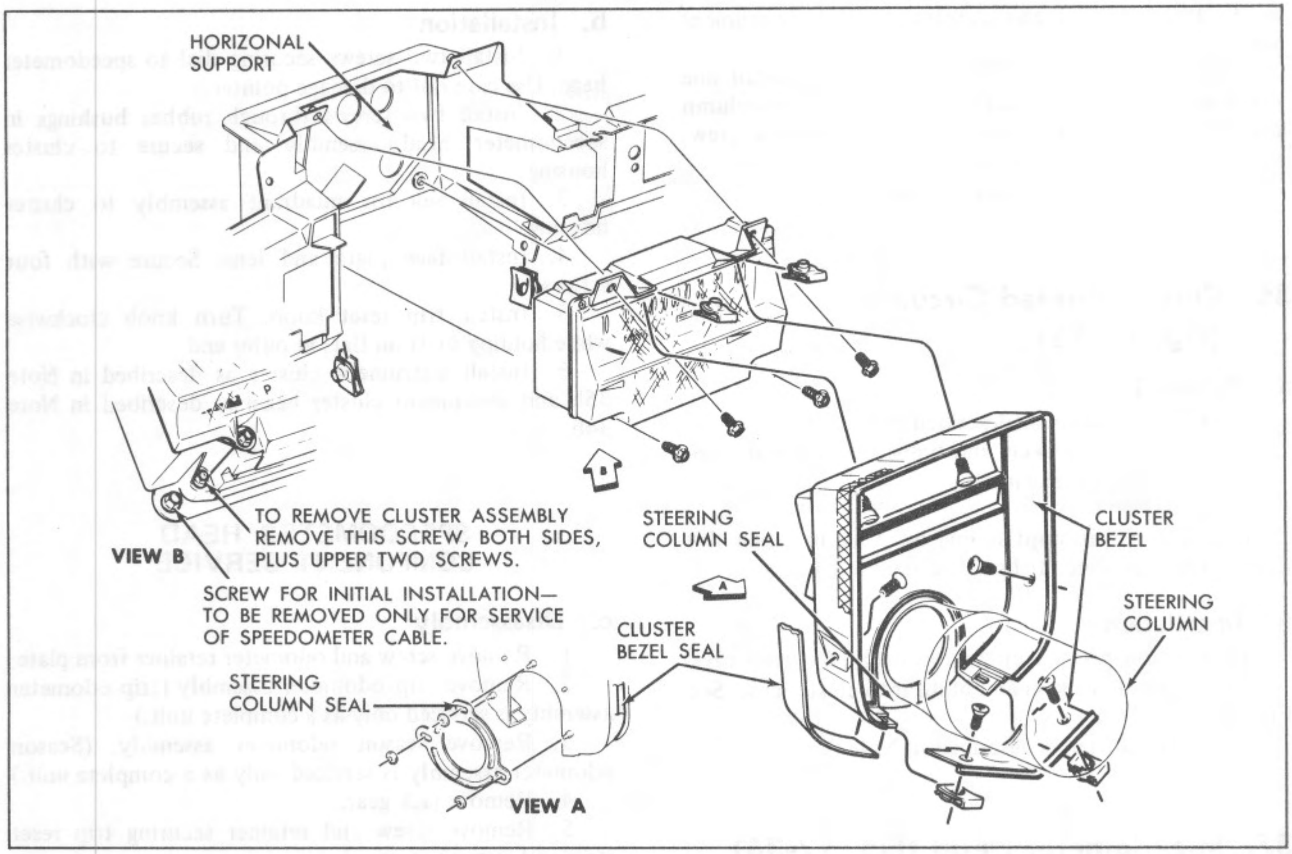


Fig. 12-35 Instrument Panel Cluster and Bezel

2. Slide top cover into position and tighten nut securing cover to instrument panel brace on fire wall.
3. Install screw securing top cover to right side of instrument panel and two top cover-to horizontal support studs.
4. Connect radio front speaker connector at radio.
5. Install instrument panel pad as described in Note 32b.

34. Instrument Panel Cluster Bezel Assembly (Fig. 12-35)

a. Removal

1. Remove six screws securing bezel to cluster and remove bezel.

(NOTE: Bezel comes out in two pieces. Steering column seal is attached to bezel and split on lower surface for removal.)

b. Installation

1. Position upper bezel against cluster and secure with 4 screws.
2. Position lower bezel and steering column seal to steering column.
3. Secure with two screws.

35. Instrument Panel Cluster (Fig. 12-35)

a. Removal

1. Disconnect negative battery cable.
2. Remove cluster bezel as described in Note 34a.
3. With shift lever in "P" (Park) remove one screw securing shift indicator cable to steering column.
4. Remove two upper screws securing cluster assembly to instrument panel horizontal support.
5. Remove two lower inboard screws securing cluster to horizontal support.

(NOTE: Two outboard screws remain in place to rear speedometer cable mounting.)

6. Pull cluster outward to disengage from speedometer cable, rotate top downward and disconnect printed circuit connector.
7. Remove cluster.

(NOTE: Removal or installation can be facilitated by placing shift lever in low range and on cars equipped with tilt wheel, placing the wheel in lowest position.)

b. Installation

1. Connect printed circuit connector to cluster.
2. Place cluster into position in the instrument panel and engage speedometer cable.

3. Install four screws securing cluster to instrument panel.

4. With column in "P" (Park) loosely install one screw securing shift indicator cable to steering column and align pointer with column in Neutral. Tighten screw.

5. Install cluster bezel as described in Note 34b.

6. Connect negative battery cable.

36. Cluster Printed Circuit (Fig. 12-22)

a. Removal

1. Remove cluster as described in Note 35a.
2. Remove all sockets and bulbs from cluster case.
3. Remove printed circuit.

(NOTE: No attempt should be made to repair this circuit. If inoperative, it should be replaced.)

b. Installation

1. Position printed circuit on back of cluster case.
2. Install all sockets and bulbs into cluster case. See Fig. 12-23.
3. Install cluster as described in Note 35b.

37. Speedometer Head (Fig. 12-36)

a. Removal

1. Remove instrument cluster as described in Note 35a.
2. Remove four screws securing instrument cluster lens to cluster housing.
3. Remove trip reset knob by turning counterclockwise. Hold shaft on flats under knob.
4. Remove lens and face plate.
5. Remove selector quadrant assembly from cluster housing by pulling straight out.
6. Remove two rubber mounted screws securing speedometer head assembly and remove from cluster housing.
7. Remove two screws securing dial to speedometer head and remove dial. Use care not to damage pointer.

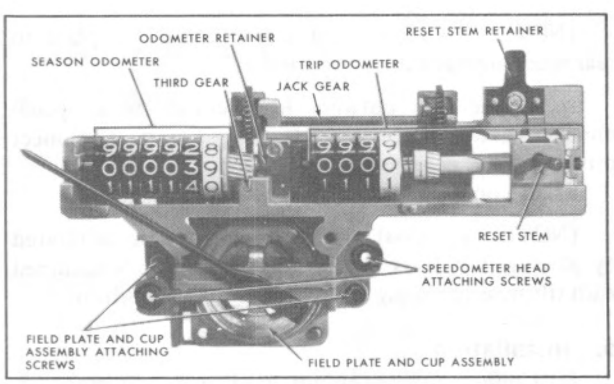


Fig. 12-36 Speedometer Head

b. Installation

1. Install two screws securing dial to speedometer head. Use care not to damage pointer.
2. Install two screws through rubber bushings in speedometer head assembly and secure to cluster housing.
3. Install selector quadrant assembly to cluster housing.
4. Install face plate and lens. Secure with four screws.
5. Install trip reset knob. Turn knob clockwise while holding shaft on flats at outer end.
6. Install instrument cluster as described in Note 35b and instrument cluster bezel as described in Note 34b.

SPEEDOMETER HEAD COMPONENT SERVICE

c. Disassembly

1. Remove screw and odometer retainer from plate.
2. Remove trip odometer assembly (trip odometer assembly is serviced only as a complete unit.)
3. Remove season odometer assembly. (Season odometer assembly is serviced only as a complete unit.)
4. Remove jack gear.
5. Remove screw and retainer securing trip reset stem and remove stem.

(NOTE: Further diassembly requires removal of field plate and speed cup assembly and subsequent recalibration of speedometer. If speedometer tester is not available for recalibration, repairs requiring disassembly beyond this point should be referred to your designated speedometer service station.)

6. Carefully remove painted aluminum pointer assembly (press fit). Turn against zero stop and lightly lift pointer assembly at hub.
7. Remove two screws securing field plate to frame and remove field plate and speed cup by lifting out by the speed cup spindle.
8. Remove third gear.
9. Inspect second gear for signs of damage. Do not remove unless necessary. Remove from frame assembly if necessary.

(NOTE: Further disassembly, such as removal of the magnet shaft from frame and speed cup assembly is not recommended.)

d. Assembly

1. If removed, position second gear in frame assembly with gear end contacting worm gear magnet shaft.
2. Position third gear with bevel gear end engaging worm gear end on second gear.
3. If removed, install speed cup (with notched side up) and field plate by holding speed cup spindle and guiding assembly onto dowels. Retain with two screws and tighten uniformly.

(NOTE: Make sure speed cup stop tab is on correct side of field plate so as to permit needle rotation. Hairspring coil on speed cup must be evenly spaced when in wound position. It may be necessary to use tweezers to adjust coils. Move regulator arm to horizontal position, if necessary, so that maximum adjustment may be made in either direction during calibration.)

4. Install trip odometer reset shaft, retainer plate and screw, being sure retainer plate engages groove in reset stem.
5. Install jack gear.
6. Rotate all odometer wheels to the top of their travel.
7. Wipe odometers clean of fingerprints with a lint free cloth or soft chamois.
8. Install odometers, making sure slotted ears of pinion carriers fit in locating slots.
9. Install retainer plate and secure with one screw.
10. Mount pointer on tapered spindle so that it points at approximately 30 mph. Twist pointer back to, and in line with, "O" graduation while pressing down lightly.
11. Check for secure pointer to spindle contact by inserting a short piece of speedometer cable with proper tip in drive end of speedometer. An initial fast spin of test cable should swing pointer to approximately 30 mph and then briskly return to "O". Perform this test several times. If pointer becomes loose on spindle, repeat Step 10.
12. If during the performance of Step 11, pointer returns to "O" intermittently or not at all, this indicates a speed cup and magnet assembly malfunction.
13. If field plate and speed cup assembly were removed, calibrate speedometer assembly, following the instructions furnished by the manufacturer for the speedometer tester being used.
14. Install speedometer head assembly as described in Note 37b.

38. Twilight Sentinel Photocell (Fig. 12-34)

(NOTE: Should it be necessary to replace the photocell, both photocell and amplifier must be replaced as a matched set.)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control air outlet grilles–right, left, and right center–as described in Note 30a.
3. Working through outlet openings, remove three fasteners securing pad to instrument panel support.
4. Remove screws securing pad to horizontal support and move pad rearward to gain access to photocell.
5. Rotate plastic photocell holder counterclockwise to remove from underside of top cover.
6. Remove photocell from plastic holder.

b. Installation

1. Insert photocell into plastic holder.
2. Insert plastic holder into underside of top cover and rotate clockwise.
3. Position pad and secure with screws to horizontal support.
4. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.
5. Install air outlet grilles as described in Note 30b.
6. Connect negative battery cable.

39. Twilight Sentinel Amplifier (Fig. 12-32)

(NOTE: Should it be necessary to replace an amplifier, both amplifier and photocell must be replaced as a matched set.)

a. Removal

1. Remove two screws and washers securing amplifier to lower steering column cover reinforcement.
2. Disconnect electrical connector at amplifier and remove amplifier.

b. Installation

1. Connect electrical connector at amplifier.
2. Position amplifier on lower steering column cover reinforcement and secure with two screws and washers.

40. Tell-Tale Printed Circuit

a. Removal

1. Remove instrument panel top cover as described in Note 33a.
2. With cover lying top down on bench, remove all tell tale bulbs and sockets.

(NOTE: Bulbs must be reinstalled in correct locations for proper functioning of warning circuits.)

3. Remove screw securing printed circuit to tell tale housing and remove printed circuit.

b. Installation

1. Position printed circuit on tell tale housing and secure with one screw.

(NOTE: Circuit is positioned to connector opening with double sided tape. Printed circuit tabs <u>must</u> be centrally positioned to insure proper connections.)

2. Install all tell tale bulbs and sockets.
3. Install top cover as described in Note 33b.
4. Install instrument panel pad as described in Note 32b.

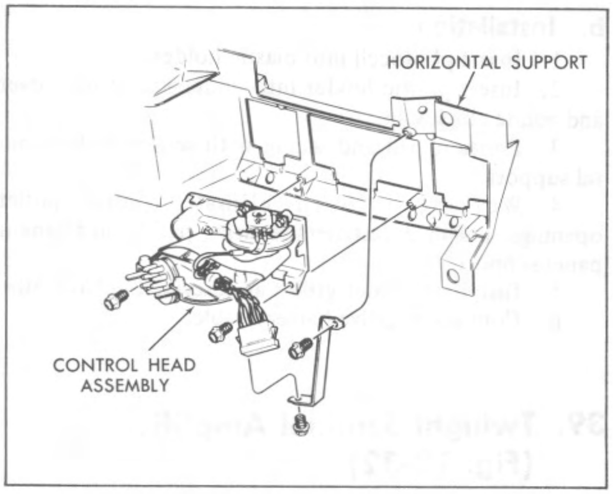


Fig. 12-37 Air Conditioner Control Head

41. Tell-Tale Housing (Components and Lenses) (Fig. 12-34)

a. Removal

1. Remove tell-tale printed circuit as described in Note 40a.
2. Remove two screws securing fuel gage and remove gage.
3. Remove remaining tell tale housing and extensions to top cover screws and remove housing assembly.
4. Remove tell tale housing cover screws, cover and tell tale lenses.

b. Installation

1. Position tell tale lenses into housing install cover and secure with screws.
2. Position tell tale housing onto top cover and install attaching screws.
3. Install fuel gage to tell tale housing with two screws.
4. Attach printed circuit board to tell tale housing cover.
5. Install printed circuit connector and bulbs.
6. Install instrument panel top cover as described in Note 33b and instrument panel pad as described in Note 32b.

42. Air Conditioning Control Head (Fig. 12-37)

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 31a.
3. Remove two control to support mounting screws.
4. Remove control to bracket mounting screw from left rear corner of control.
5. Remove control from support and disconnect vacuum connector, electrical connector and bulb.

b. Installation

1. Connect vacuum connector, electrical connector and bulb to control.
2. Install control to support and bracket and attach with three mounting screws.
3. Install lower steering column cover as described in Note 31b.
4. Connect negative battery cable.

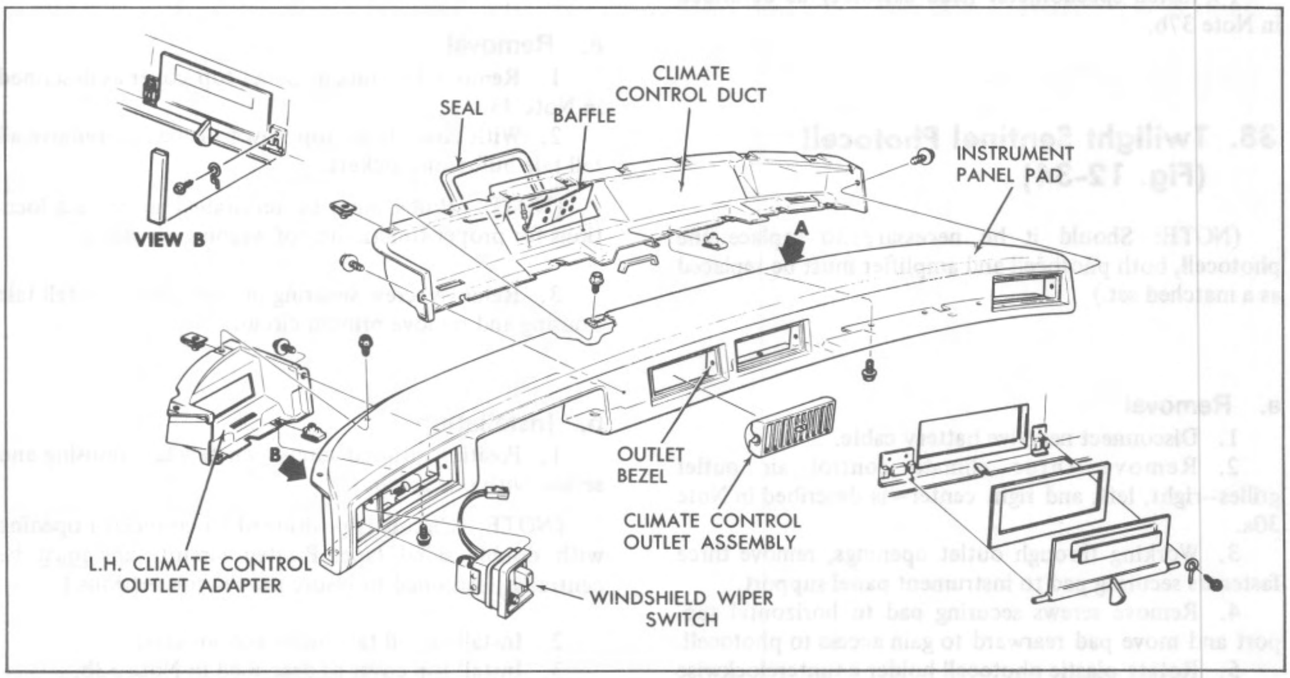


Fig. 12-38 Instrument Panel Pad Disassembled

43. Climate Control In-Car Sensor (Fig. 12-34)

a. Removal

1. Remove instrument panel top cover as described in Note 33a.
2. Disconnect aspirator hose from sensor. Remove two screws securing sensor to tell tale assembly and remove sensor.

b. Installation

1. Position sensor on tell tale assembly and secure with two screws. Connect aspirator hose to sensor.
2. Install instrument panel top cover as described in Note 33b. and instrument panel pad as described in Note 32b.

44. Climate Control Outlet Doors and Bezels (Fig. 12-38)

a. Removal

1. Remove instrument panel pad as described in Note 32a.
2. With pad lying face down on bench, remove two screws and plastic guides securing door to pad and remove door.
3. Push bezel out of pad from the rear side of the pad.

b. Installation

1. Push bezel into instrument panel pad from the front side of the pad.
2. Position door on pad and secure with two plastic guides and screws.
3. Install instrument panel pad as described in Note 32b.

45. Climate Control Duct—Left Side (Fig. 12-38)

a. Removal

1. Remove instrument panel pad as described in Note 32a.
2. Remove 4 screws securing duct to cover and remove duct.

b. Installation

1. Position duct on cover and secure with 4 screws.
2. Install instrument panel pad as described in Note 32b.

46. Climate Control Duct—Right Side (Fig. 12-38)

a. Removal

1. Remove instrument panel pad as described in Note 32a.
2. With panel lying face down on bench, remove 15 screws securing right hand duct to panel and remove duct.

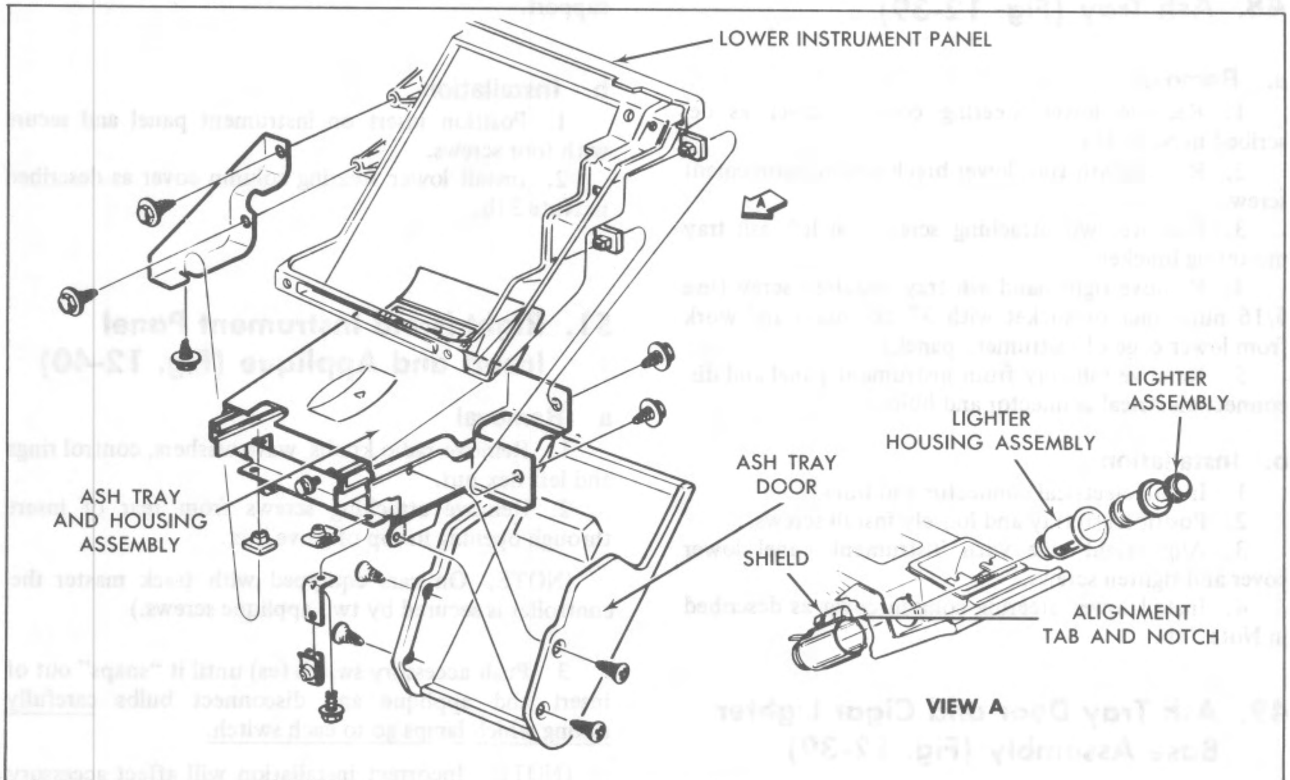


Fig. 12-39 Ash Tray Disassembled

b. Installation

1. Position duct onto panel and secure with 15 screws.
2. Install instrument panel pad as described in Note 32b.

47. Windshield Wiper Switch (Fig. 12-38)

a. Removal

1. Disconnect negative battery cable.
2. Remove left hand climate control outlet grille as described in Note 30a.
3. Working through outlet opening, remove screw securing switch to instrument panel.
4. Pull wiper switch and electrical connector out of panel and disconnect from harness.

(NOTE: Standard "Mist" wiper switch has a single connector. Optional "Controlled Cycle" wiper switch has two connectors.)

b. Installation

1. Install electrical connector to harness and position switch into instrument panel pad opening.
2. Working through air outlet grille, install screw securing switch to instrument panel.
3. Install left hand climate control outlet grille as described in Note 30b.
4. Connect negative battery cable.

48. Ash Tray (Fig. 12-39)

a. Removal

1. Remove lower steering column cover as described in Note 31a.
2. Remove ash tray lower bracket to reinforcement screw.
3. Remove two attaching screws on left ash tray mounting bracket.
4. Remove right hand ash tray attaching screw (use 5/16 nutrunner or socket with 3" extension and work from lower edge of instrument panel.)
5. Remove ash tray from instrument panel and disconnect electrical connector and bulb.

b. Installation

1. Install electrical connector and bulb.
2. Position ash tray and loosely install screws.
3. Align right side with instrument panel lower cover and tighten screws.
4. Install lower steering column cover as described in Note 31b.

49. Ash Tray Door and Cigar Lighter Base Assembly (Fig. 12-39)

a. Removal

1. Open ash tray and depress flat stop spring.
2. Pull ash tray out just enough to gain access to four screws.
3. Remove four screws securing ash tray door to ash tray housing
4. Disconnect cigar lighter electrical connector.
5. Disconnect ash tray housing bulb and shield.
6. Remove lighter base from sleeve by holding sleeve and rotating lighter base.
7. Remove lighter base from ash tray housing.

b. Installation

1. Position lighter base in ash tray housing.
2. Hold lighter sleeve in position and screw base into sleeve. Bulb shield must face up when tight to allow light to enter ash tray receptacle.
3. Connect ash tray housing bulb shield and feed wires to cigar lighter base.
4. Secure ash tray door to ash tray housing with four screws.
5. Depress flat stop spring and push ash tray assembly forward.

50. Left Hand Instrument Panel Insert (Fig. 12-40)

a. Removal

1. Remove lower steering column cover as described in Note 31a.
2. Remove four screws securing insert to horizontal support.

b. Installation

1. Position insert on instrument panel and secure with four screws.
2. Install lower steering column cover as described in Note 31b.

51. Right Hand Instrument Panel Insert and Applique (Fig. 12-40)

a Removal

1. Remove radio knobs, wave washers, control rings and left hex nut.
2. Remove attaching screws from rear of insert through opening in top of glove box.

(NOTE: On cars equipped with track master the controller is secured by two applique screws.)

3. Push accessory switch (es) until it "snaps" out of insert and applique and disconnect bulbs carefully noting which lamps go to each switch.

(NOTE: Incorrect installation will affect accessory switch lighting.)

4. Disconnect map light connector.

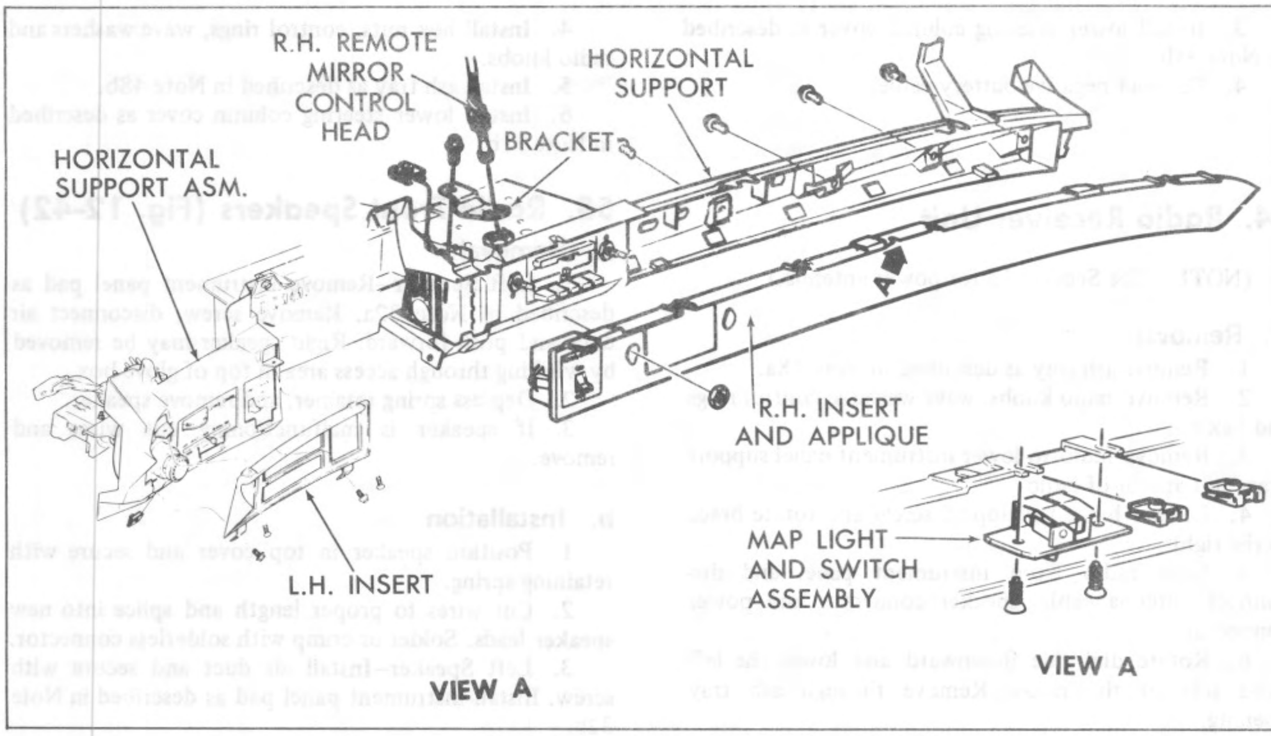


Fig. 12-40 Inserts, Appliques and Accessory Switches

b. Installation

1. Connect map light connector.
2. Connect accessory switch (es) and bulbs to insert and applique in the exact position from which they were removed. See Fig. 12-43.
3. Position insert and applique onto support and install screws.
4. Install left hex nut, control rings, wave washers and radio knobs.

52. Headlamp Switch (Guide Matic or Twilight Sentinel Switch) (Fig. 12-41)

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 31a.
3. Disconnect headlamp electrical connector and lower bulb.
4. Pull knob to "headlamps on" position, depress spring loaded button on top side of switch and while holding the button remove the knob, escutcheon and washer.
5. Remove headlamp switch case to instrument panel support screw.
6. Lower switch assembly, disconnect upper bulb and remove switch.

b. Installation

1. Position switch assembly (connector down), install upper bulb and position into instrument panel.
2. Secure with attaching screw.
3. Install knob, escutcheon and washer by depressing spring loaded button on top side of switch and while holding the button insert the knob, escutcheon and washer into the switch.
4. Connect headlamp electrical connector and lower bulb.
5. Install lower steering column cover as described in Note 31b.
6. Connect negative battery cable.

53. Cruise Control Switch

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 31a.
3. Disconnect cruise control electrical connectors and bulbs.
4. Remove two switch to instrument panel horizontal support screws.

(NOTE: Use of a three inch extension will aid in the removal of upper screw.)

5. Remove switch assembly.

b. Installation

1. Position switch assembly into instrument panel and install two attaching screws.
2. Connect cruise control electrical connectors and bulbs.

3. Install lower steering column cover as described in Note 31b.

4. Connect negative battery cable.

54. Radio Receiver Unit

(NOTE: See Section 15 for power antenna.)

a. Removal

1. Remove ash tray as described in Note 48a.
2. Remove radio knobs, wave washers, control rings and hex nuts.
3. Remove radio to lower instrument panel support brace nut at rear of radio.
4. Loosen brace to support screw and rotate brace to the right.
5. Slide radio from instrument panel and disconnect antenna cable, speaker connector and power connector.
6. Rotate dial side downward and lower the left hand side of the radio. Remove through ash tray opening.

b. Installation

1. Position radio into instrument panel, connect antenna cable, speaker connector and power connector.
2. Install brace onto radio and tighten support screw.
3. Install radio to brace nut.
4. Install hex nuts, control rings, wave washers and radio knobs.
5. Install ash tray as described in Note 48b.
6. Install lower steering column cover as described in Note 31b.

55. Radio Front Speakers (Fig. 12-42)

a. Removal

1. Left Speaker–Remove instrument panel pad as described in Note 32a. Remove screw, disconnect air duct and push forward. Right speaker may be removed by working through access area in top of glove box.
2. Depress spring retainer, and remove speaker.
3. If speaker is malfunctioning cut wires and remove.

b. Installation

1. Position speaker in top cover and secure with retaining spring.
2. Cut wires to proper length and splice into new speaker leads. Solder or crimp with solderless connector.
3. Left Speaker–Install air duct and secure with screw. Install instrument panel pad as described in Note 32b.

56. Radio Front Speaker Grilles (Fig. 12-42)

a. Removal

1. Remove instrument panel top cover as described in Note 33a.
2. Remove speaker by releasing spring retainer.

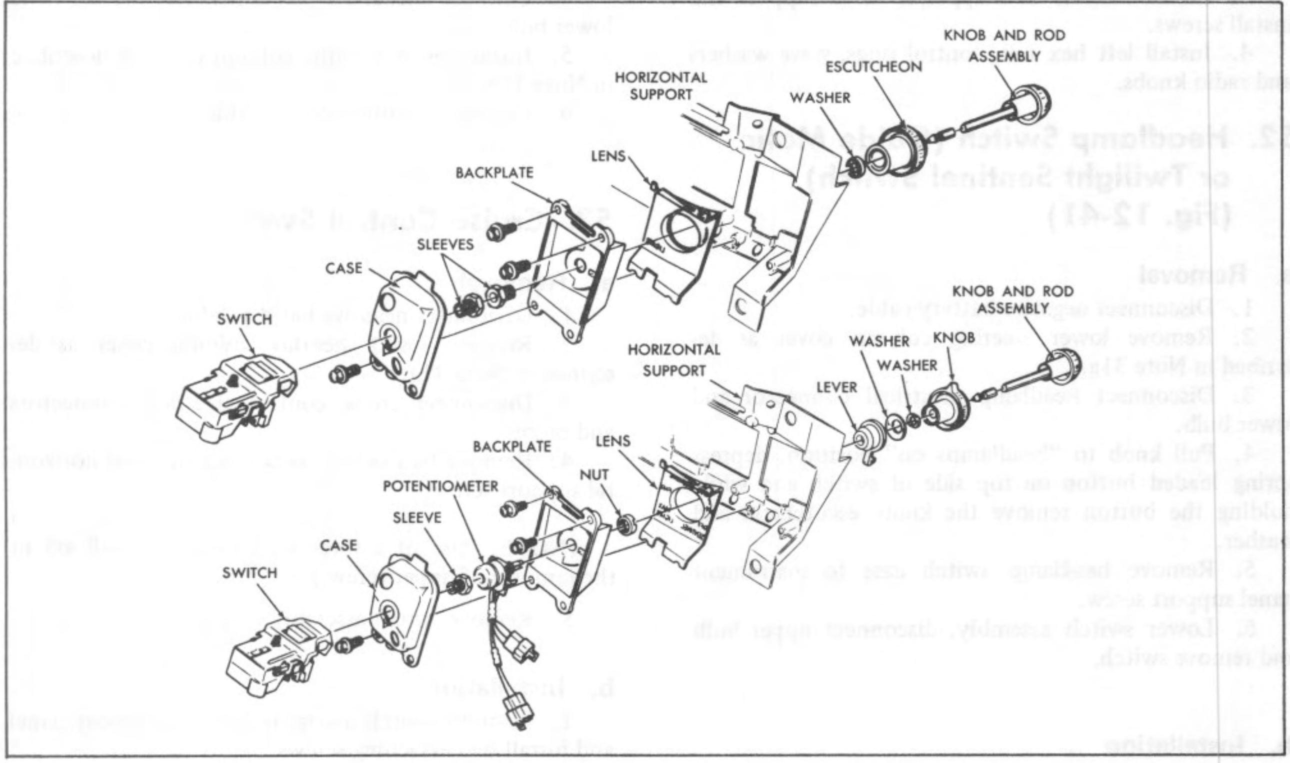


Fig. 12-41 Light Switches Disassembled

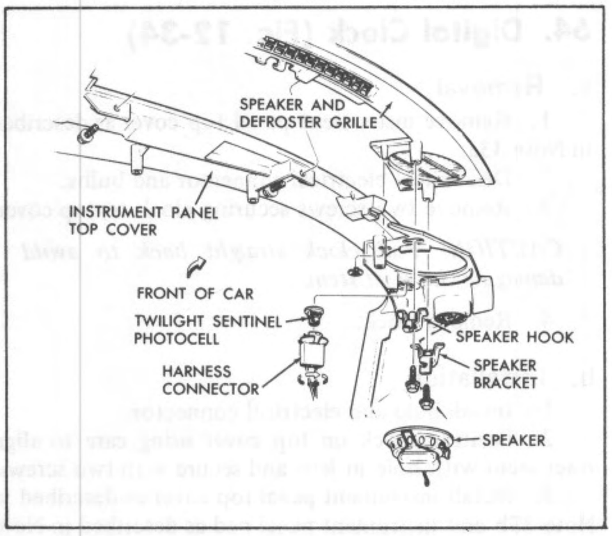


Fig. 12-42 Radio Speaker and Speaker/Defroster Grille

3. Remove two screws securing speaker mounting brackets to top cover and remove brackets.

(NOTE: Left grille:

a. Remove two screws securing left hand tell tale extension to top cover.

b. Remove eight screws securing tell tale base to top cover. Remove tell tale side clock mounting screw only.

c. Carefully pivot tell tale assembly to gain access to speaker grille mounting screw.)

4. Remove two screws securing speaker grille to top cover and remove grille.

b. Installation

1. Position speaker grille on top cover and secure with two screws.

(NOTE: Left grille–install tell tale base and extension to top cover.)

2. Install speaker mounting brackets and secure each with two screws.
3. Install speaker with retaining spring.
4. Install instrument panel top cover as described in Note 33b.
5. Install instrument panel pad as described in Note 32b.

57. Power Antenna Relay

a. Removal

1. Pull carpet away from front passenger side toe pan.
2. Disconnect two electrical connectors.
3. Remove two screws and washers securing relay and bracket to toe pan.

b. Installation

1. Position relay and bracket on toe pan and secure with two screws.
2. Connect electrical connectors.
3. Reposition carpet.

58. Theft Deterrent Switch

a. Removal

1. Working through access area in top of glove box disconnect electrical connector at harness.
2. Remove hex nut from switch.
3. Remove switch.

b. Installation

1. Position switch in glove box and install hex nut.
2. Connect electrical connector to harness.

59. Theft Deterrent Controller

See Section 15 for removal and installation of theft deterrent controller.

60. Track Master Controller

a. Removal

1. Reaching through the top of glove box, disconnect the electrical connectors from the upper right hand side of the controller.
2. Loosen two support screws.
3. Slide controller and mounting bracket upward (bracket is slotted) and remove through glove box opening.

b. Installation

1. Working through the top of glove box position controller and bracket onto support screws.
2. Tighten screws.
3. Connect the electrical connectors to the upper right hand side of the controller.

(NOTE: The connectors are not interchangeable. The connector toward the front of the car is notched.)

61. Accessory Switches and Housing (Power Antenna, Defogger, Sun Roof, Convertible Top) (Fig. 12-40)

a. Removal

1. Remove instrument panel pad as described in Note 32a.
2. Remove right hand insert and applique as described in Note 51a.
3. Push switch from insert and applique side of instrument panel until it "snaps" out of the accessory switch housing.

(NOTE: Accessory switch housing need not be removed in accessory switch replacement.)

4. Remove accessory switch wiring terminals from accessory switch electrical connector.

5. Remove two screws and accessory switch housing.

b. Installation

1. Position accessory switch housing and install two housing to instrument panel support screws.

2. Install accessory switch wiring terminals into accessory switch electrical connector.

(NOTE: See chassis wiring circuit diagram on back cover gatefold for wiring color codes.)

3. Push accessory switch into the switch housing until it "snaps" into position.

4. Install right hand insert and applique as described in Note 51b.

5. Install instrument panel pad as described in Note 32b.

62. Accessory Switch Bulb Replacement (Power Antenna, Defogger, Sun Roof, Convertible Top) (Fig. 12-43)

a. Removal

1. Remove radio knobs, wave washers, control rings and left hand hex nut.

2. Remove left hand insert and applique to horizontal support screw.

3. Gently pull left edge of applique until bulb sockets are exposed.

4. Remove bulb.

b. Installation

1. Install new bulb.

2. Position insert and applique against horizontal support.

3. Install left hand retaining screw.

4. Install left hand radio hex nut, control rings, wave washers and knobs.

63. Fuel Gage (Fig. 12-34)

a. Removal

1. Remove instrument panel top cover as described in Note 33a.

2. Remove two screws securing gage to top cover.

3. Remove gage.

b. Installation

1. Position fuel gage on top cover and secure with two screws.

2. Install instrument panel top cover as described in Note 33b and instrument panel pad as described in Note 32b.

64. Digital Clock (Fig. 12-34)

a. Removal

1. Remove instrument panel top cover as described in Note 33a.

2. Disconnect electrical connector and bulbs.

3. Remove two screws securing clock to top cover.

CAUTION: Pull clock straight back to avoid damaging the reset stem.

4. Remove clock.

b. Installation

1. Install bulb and electrical connector.

2. Position clock on top cover using care to align reset stem with hole in lens and secure with two screws.

3. Install instrument panel top cover as described in Note 33b and instrument panel pad as described in Note 32b.

65. Rear Window Defogger Relay

a. Removal

1. Disconnect negative battery cable.

2. Remove lower steering column cover as described in Note 31a.

3. Remove two screws which attach relay to steering column support.

4. Disconnect electrical connectors and remove relay.

b. Installation

1. Connect electrical connectors.

2. Secure relay to steering column support with two screws.

3. Install lower steering column cover as described in Note 31b.

4. Connect negative battery cable.

66. Hood Lock Primary Release

a. Removal

1. Remove clip from cable at hood lock.

2. Thread cable from radiator cradle.

3. Remove screws securing left side sill plate and remove sill plate.

4. Remove screw securing left side kick panel.

5. Partially remove kick panel to gain access to lock handle.

6. Pull handle bracket from behind tab on kick panel and remove cable assembly.

b. Installation

1. Thread cable through kick panel and fire wall.

2. Install handle assembly in kick panel so that handle is vertical and away from panel as far as possible.

3. Install handle assembly by securing under tab on kick panel.

4. Position kick panel and secure with screw.

5. Install sill plate and secure with screws.

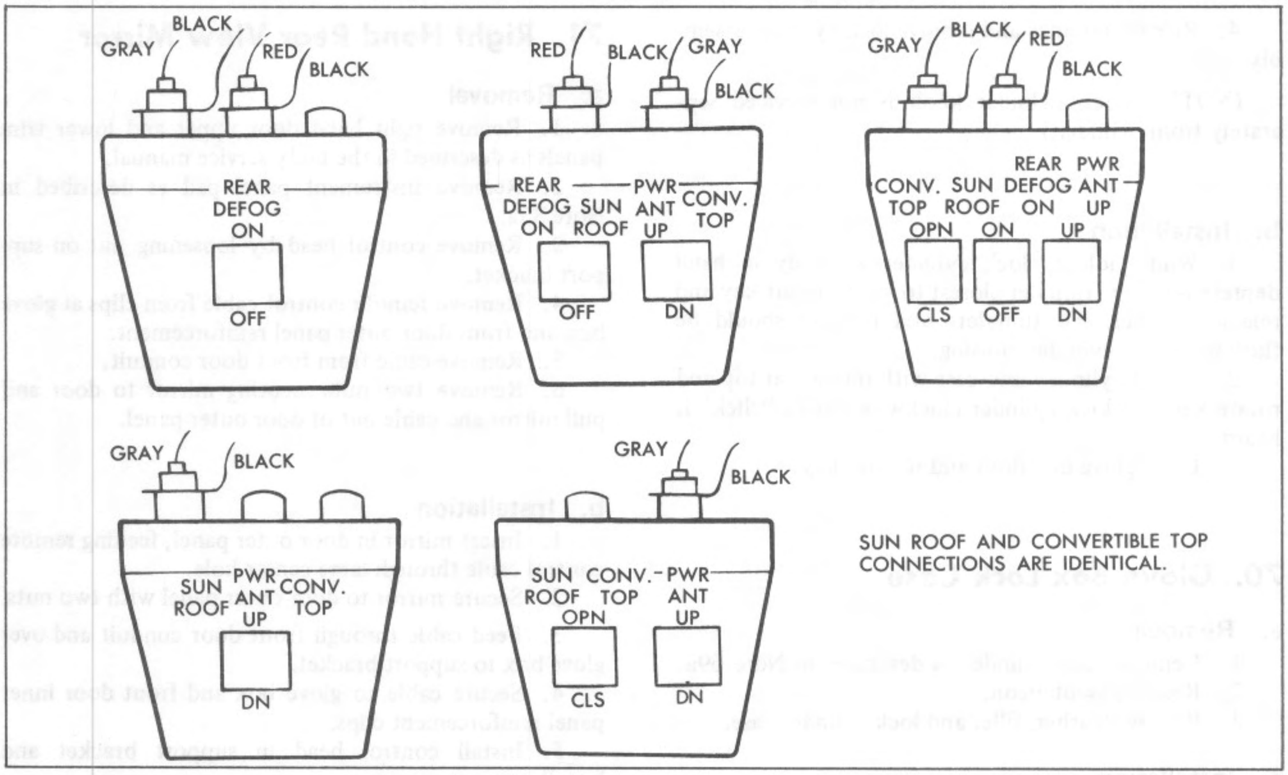


Fig. 12-43 Accessory Switch Wiring

6. Thread cable through inside of fender well and secure to hood lock latch with clip.

67. Glove Box Liner

(NOTE: Make sure Theft Deterrent System is disarmed, if car is so equipped.)

a. Removal

1. Remove Theft Deterrent manual switch from top of glove box liner, if car is so equipped.
2. Remove five screws that secure glove box liner to glove box housing.

CAUTION: Do not apply excessive downward pressure to the door at this point, as it may break the hinges.

3. Carefully remove glove box liner through door opening.

b. Installation

1. Position glove box liner into housing through door opening.
2. Align glove box liner to housing and secure with four attaching screws, leaving the upper right screw out.
3. Position right hand door stop cable to liner at upper right hand position and secure with remaining screw.
4. Install Theft Deterrent manual switch in top of liner.

68. Glove Box Door

a. Removal

1. From under side of instrument panel, remove three hinge to support screws.
2. Open glove box door and remove door stop cable screw.
3. Remove door.

b. Installation

1. Position glove box door and attach door stop cable screw.
2. Loosely install three hinge to support screws.
3. Close glove box door, align with lower instrument panel and tighten screws.

69. Glove Box Lock Cylinder

a. Removal

1. Open glove box door.
2. Insert key and pull latch mechanism arm to latch position. Turn key to lock position and remove key.
3. Through slot in top of lock case, depress cylinder retainer and insert key into lock cylinder.

4. Release retainer and remove lock cylinder assembly.

(NOTE: Lock cylinder knob is not serviced separately from cylinder.)

b. Installation

1. While holding lock cylinder assembly in hand depress retainer (tumbler closest to knob) insert key and release retainer. All tumblers and retainer should be flush with lock cylinder housing.
2. Install cylinder into case with retainer at top and rotate key and lock cylinder clockwise until a "click" is heard.
3. Close glove box door and remove key.

70. Glove Box Lock Case

a. Removal

1. Remove lock cylinder as described in Note 69a.
2. Remove escutcheon.
3. Remove washer, filler and lock cylinder case.

b. Installation

1. Posotion lock cylinder, filler and washer onto glove box door.
2. Install escutcheon.
3. Install lock cylinder as described in Note 69b.

71. Right Hand Rear View Mirror

a. Removal

1. Remove right hand door upper and lower trim panels as described in the body service manual.
2. Remove instrument panel pad as described in Note 32a.
3. Remove control head by loosening nut on support bracket.
4. Remove remote control cable from clips at glove box and front door outer panel reinforcement.
5. Remove cable from front door conduit.
6. Remove two nuts securing mirror to door and pull mirror and cable out of door outer panel.

b. Installation

1. Insert mirror in door outer panel, feeding remote control cable through large center hole.
2. Secure mirror to door outer panel with two nuts.
3. Feed cable through front door conduit and over glove box to support bracket.
4. Secure cable to glove box and front door inner panel reinforcement clips.
5. Install control head in support bracket and install nut.
6. Install instrument panel pad as described in Note 32b.
7. Install upper and lower front door trim panels as described in the body service manual.

SERVICE INFORMATION
INSTRUMENT PANEL COMPONENTS ON AIR CUSHION RESTRAINT SYSTEM EQUIPPED CARS

CAUTION: Before servicing any instrument panel component turn ignition switch to "lock," disconnect negative battery cable and tape terminal end to avoid accidental deployment.

On the items listed below remove the Driver Knee Restraint (as described in Note 74a) instead of the lower steering column cover. Then proceed as described in corresponding notes for non Air Cushion Restraint System Equipped Cars.

- L.H. Instrument Panel Insert
- Headlamp Switch
- Guide Matic or Twilight Sentinel Switch
- Cruise Control Switch.
- Air Conditioner or Heater Control
- Rear Window Defogger Relay

72. Glove Box

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove three screws securing glove box to instrument panel. Do not remove two striker screws.

(NOTE: Electrical lead wire length is sufficient to permit glove box to be placed aside while removing additional instrument panel component parts. Continue with the following steps only if glove box is to be removed from car.)

3. Remove three screws securing glove box partition.
4. Disconnect electrical connectors. Feed wires through top of glove box and remove glove box.

b. Installation

1. Feed electrical connectors through top of glove box and connect to connectors mounted to partition.
2. Position partition and secure with three screws.
3. Position glove box under instrument panel and secure with three screws.
4. Connect negative battery cable.

73. Theft Deterrent or Trunk Release Switch

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove three screws attaching glove box to instrument panel.
3. Remove three screws securing glove box partition.
4. Disconnect electrical connector and remove switch.

b. Installation

1. Install switch in glove box partition.
2. Install partition and secure with three screws.
3. Position glove box under instrument panel and secure with three screws.
4. Connect negative battery cable.

74. Driver Knee Restraint

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove glove box as described in Note 72a.
3. Remove two screws securing tape storage compartment.
4. Remove two screws securing ash tray assembly. Pull out part way, disconnect electrical connectors and remove ash tray assembly.
5. Remove left trim screw from knee restraint.
6. Remove four screws from lower edge of knee restraint and loosen (but do not remove) fifth screw directly below steering column.
7. Working through tape storage compartment and ash tray assembly openings remove four attaching screws.

b. Installation

1. Position knee restraint and loosely install left hand trim screw and right lower edge screw.
2. Loosely install four upper and three remaining lower screws.
3. Hold knee restraint firmly in position and tighten left trim screw and all attaching screws.
4. Install tape storage compartment and secure with two screws.
5. Connect cigar lighter electrical connectors, position ash tray assembly into knee restraint and secure with two screws.
6. Install glove box as described in Note 72b.
7. Connect negative battery cable.

75. Tape Storage Compartment

a. Removal

1. Open tape storage compartment door and remove two screws.
2. Pull straight out and remove door and compartment as an assembly from driver knee restraint.

b. Installation

1. Position door and compartment assembly into driver knee restraint.
2. Install two screws and close tape storage compartment door.

76. Ash Tray Assembly

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Open ash tray door and remove two screws securing ash tray assembly to driver knee restraint.
3. Pull ash tray straight out and disconnect lamp and base connector from cigar lighter.

b. Installation

1. Connect base connector and lamp to rear of cigar lighter.
2. Position ash tray and secure with two screws.
3. Connect negative battery cable.

77. Radio Receiver

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove knee restraint as described in Note 74a.
3. Remove nut from radio support on back of radio. Loosen radio support lower screw and pivot support out of way.
4. Disconnect antenna.
5. Remove radio knobs, wave washers, control rings and hex nuts.
6. Working through the knee restraint opening gently slide radio receiver from horizontal support and allow the back of the radio to lower enough to gain access to the three electrical connectors. The connectors are located on the back left hand side and are removed by depressing the lock tabs and pushing upward.
7. Pivot receiver slightly to the left to clear instrument panel support, slide toward front of car, lower dial and remove dial side first through knee restraint opening.

b. Installation

1. Carefully note the three electrical terminal positions and their locations to each other.
2. Slide receiver, back side first, through knee restraint opening. Rotate dial upward and position into horizontal support. Loosely install hex nuts.
3. Connect electrical connectors. Lock tab on the wide (front speaker) connector should face the dial. The other two face the engine.
4. While supporting receiver from bottom tighten hex nuts. Install control rings, wave washers and radio knobs.
5. Pivot radio support into position and install nut onto stud on back of receiver. Tighten lower support screw.
6. Connect antenna.
7. Install knee restraint as described in Note 74b.
8. Install glove box as described in Note 72b.
9. Connect negative battery cable.

78. Radio Front Speakers

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 32a.
3. Remove screw securing air duct and push duct forward.
4. Depress spring retainer and remove speaker.
5. If speaker is malfunctioning cut wires and remove.

b. Installation

1. Position speaker in top cover and secure with retainer spring.
2. Cut wires to proper length and splice into new speaker leads. Solder on crimp with solderless connector.
3. Install air duct and secure with screw.
4. Install instrument panel pad as described in Note 32b.
5. Connect negative battery cable.

79. Right Hand Insert and Applique

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 32a.
3. Remove radio control knobs, wave washers and left hex nut.
4. "Snap" electrical accessory switches from insert and disconnect map light connector.
5. Working through instrument panel pad opening remove screws that secure insert and applique to horizontal support.
6. Remove applique from horizontal support.

b. Installation

1. Position insert and applique onto horizontal support.
2. Install horizontal support to insert and applique attaching screws.
3. Connect accessory switch and map light electrical connectors.
4. Install left hex nut, control rings, wave washers and radio knobs.
5. Install instrument panel pad as described in Note 32b.
6. Connect negative battery cable.

80. Right Hand Lower Trim Cover

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove glove box as described in Note 72a.
3. Remove knee restraint as described in Note 74a.
4. Remove instrument panel pad as described in Note 32a.
5. Remove R.H. insert and applique as described in Note 79a.
6. Remove six trim cover upper attaching screws through openings in the horizontal support.
7. Remove right hand trim screw.
8. Remove left hand trim cover to knee restraint brace screw.
9. Pull top of R.H. lower trim cover from horizontal support and unhook it from the air cushion restraint assembly lower edge.

b. Installation

1. Hook R.H. lower trim assembly onto air cushion restraint assembly and insert top edge between the horizontal support and reinforcement.
2. Install eight attaching screws.
3. Install R.H. insert and applique as described in Note 79b.
4. Install instrument panel pad as described in Note 32b.
5. Install knee restraint as described in Note 74b.
6. Install glove box as described in Note 72b.
7. Connect negative battery cable.

81. Theft Deterrent Controller

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 32a.
3. Disconnect theft deterrent controller electrical connector.
4. Remove screw that secures controller to center reinforcement.

b. Installation

1. Install controller to reinforcement with attaching screw.

2. Connect theft deterrent controller electrical connector.

3. Install instrument panel pad as described in Note 32b.

4. Connect negative battery cable.

82. Track Master Controller

a. Removal

1. Disconnect negative battery cable and tape terminal end.

2. Remove instrument panel pad as described in Note 32a.

3. Disconnect electrical connectors from right hand side of controller.

4. Loosen two support screws.

5. Slide controller and mounting bracket upward (bracket is slotted) and remove.

b. Installation

1. Slide controller and bracket onto mounting screws and tighten screws.

2. Connect electrical connectors to the upper right hand side of the controller.

(NOTE: The connectors are not interchangable. The connector toward the front of the car is notched.)

3. Install instrument panel pad as described in Note 32b.

4. Connect negative battery cable.

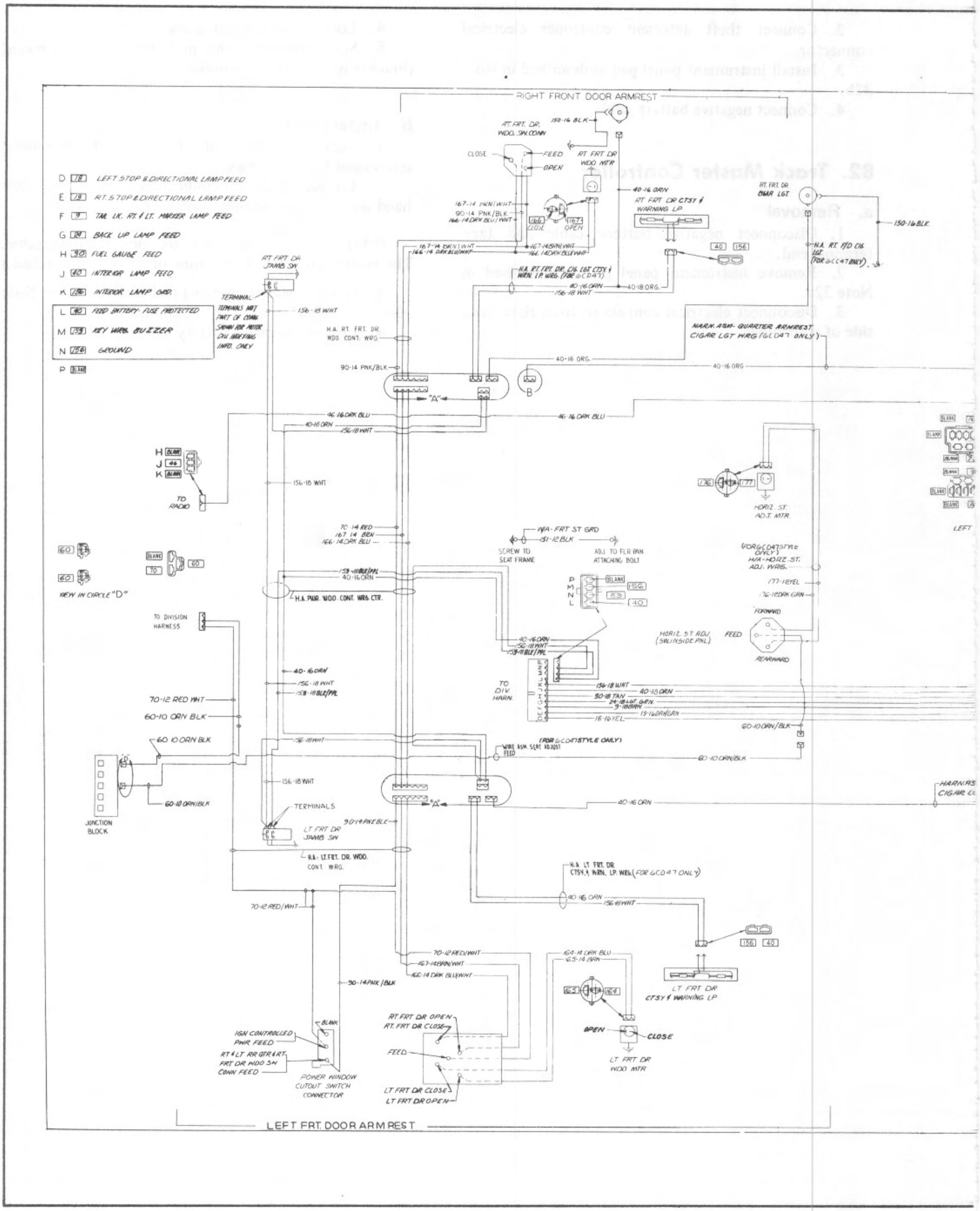


Fig. 14-44 Body Wiring Diagram (6C47, 6D47)

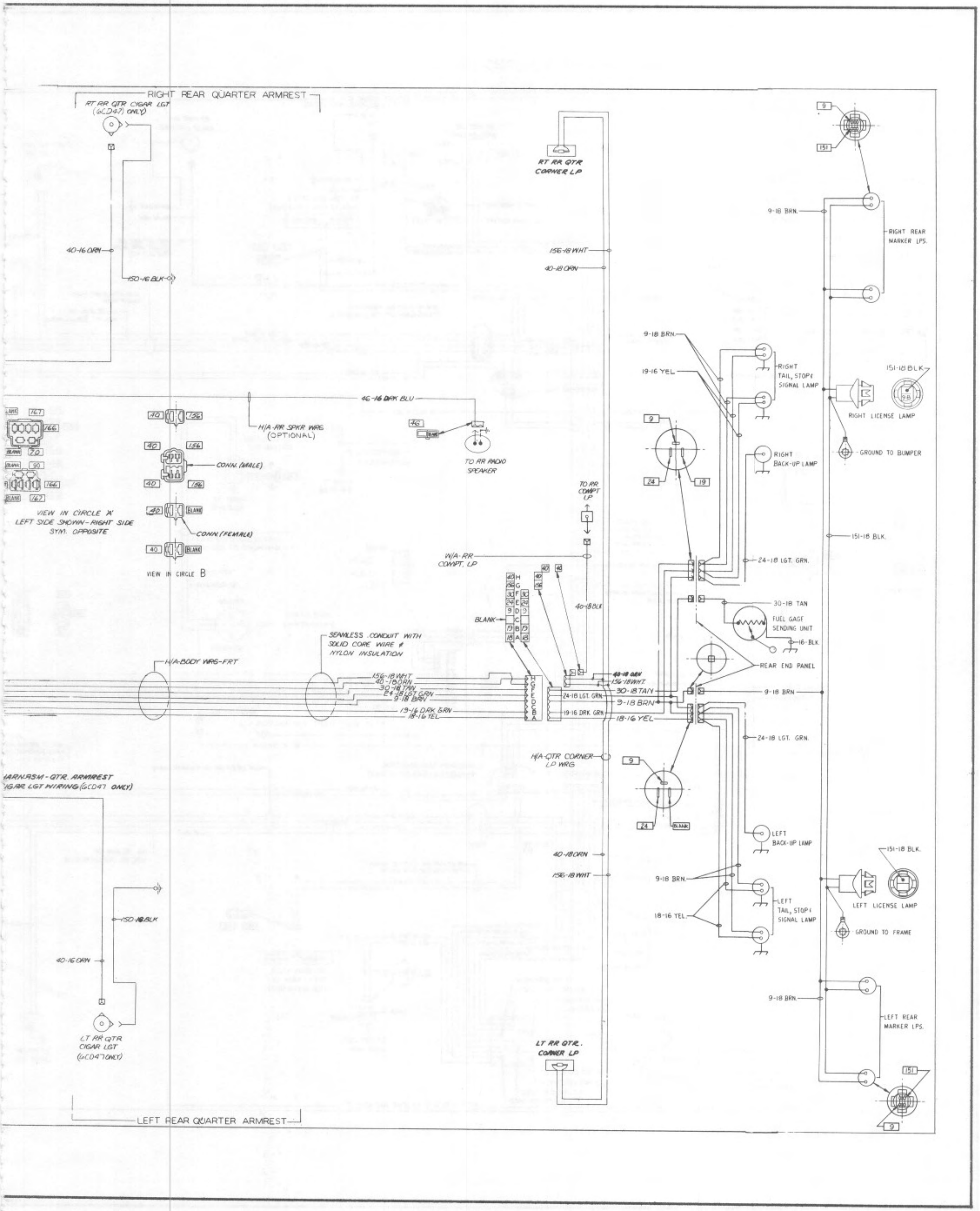


Fig. 14-44 Body Wiring Digram (6C47, 6D47)

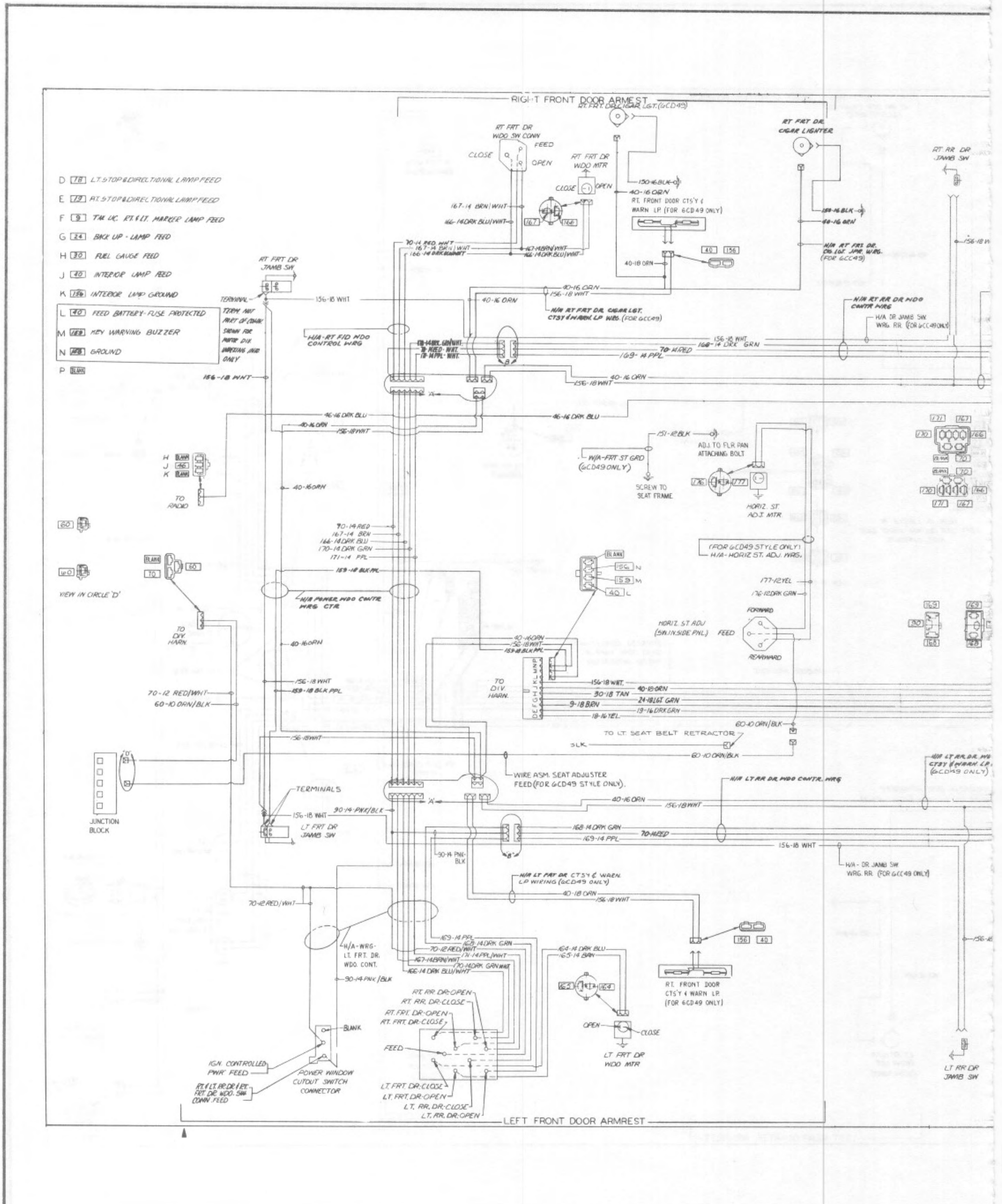


Fig. 12-45 Body Wiring Diagram (6C49, 6D49)

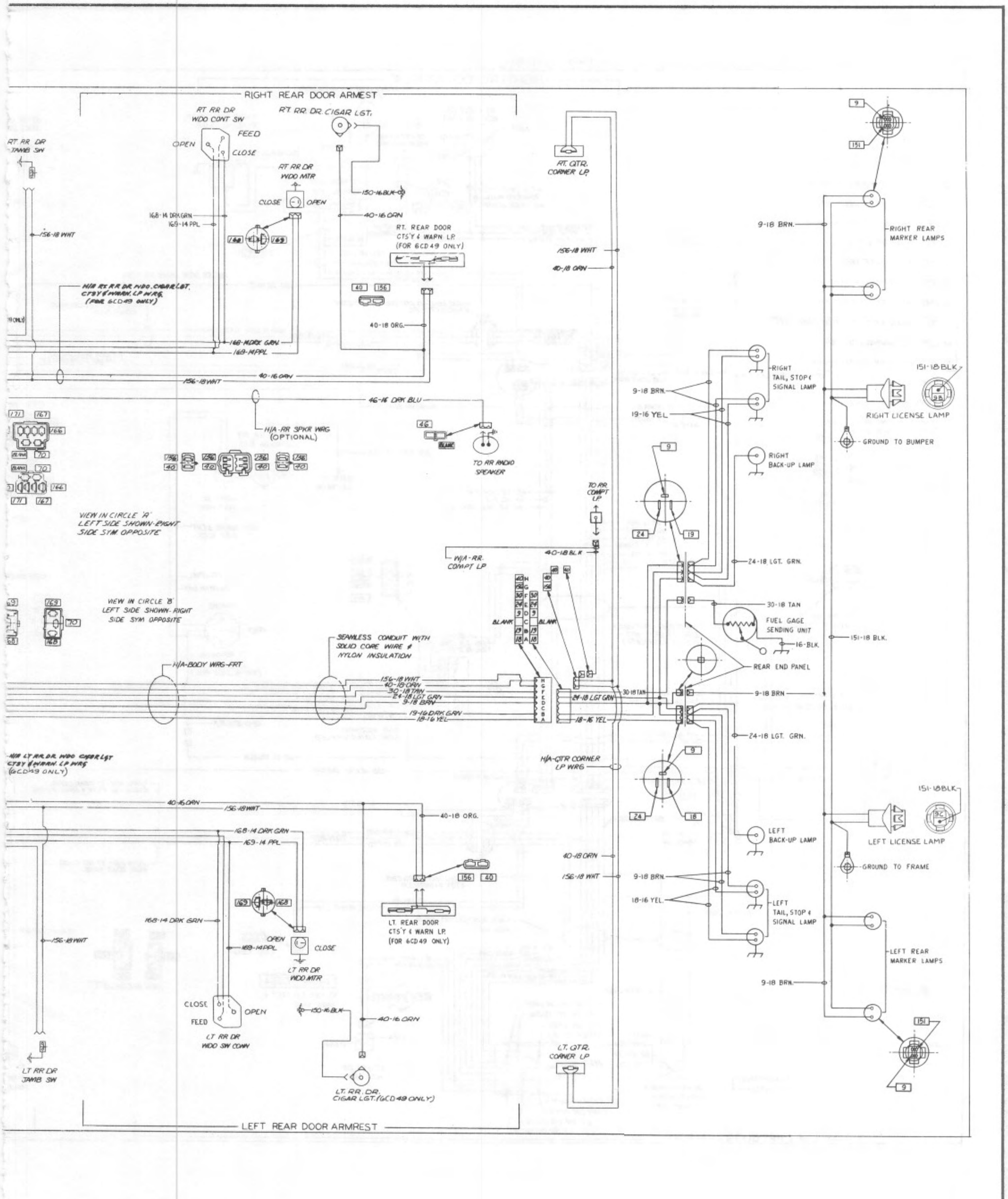


Fig. 12-45 Body Wiring Diagram (6C49, 6D49)

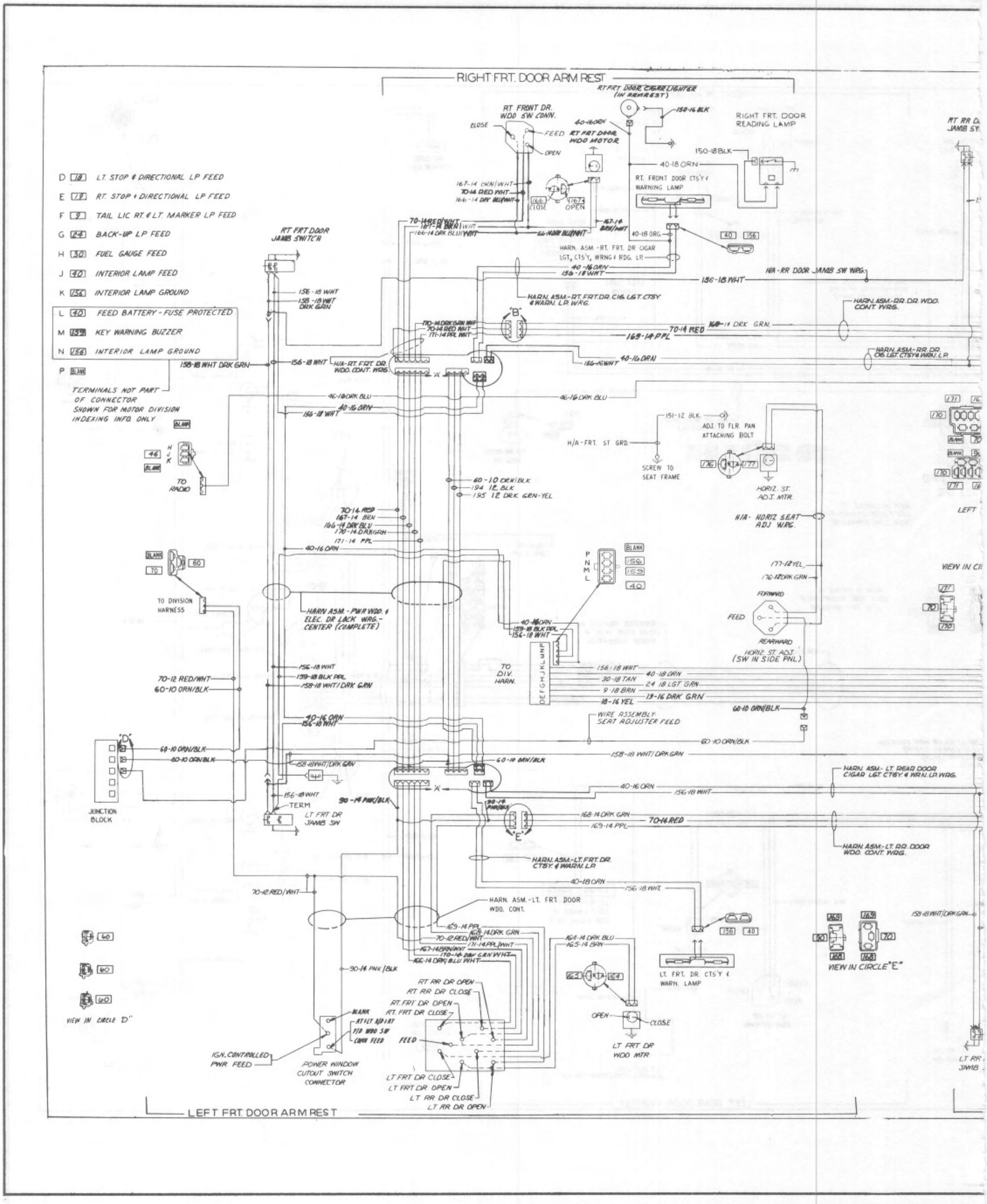


Fig. 12-46 Body Wiring Diagram (6B69)

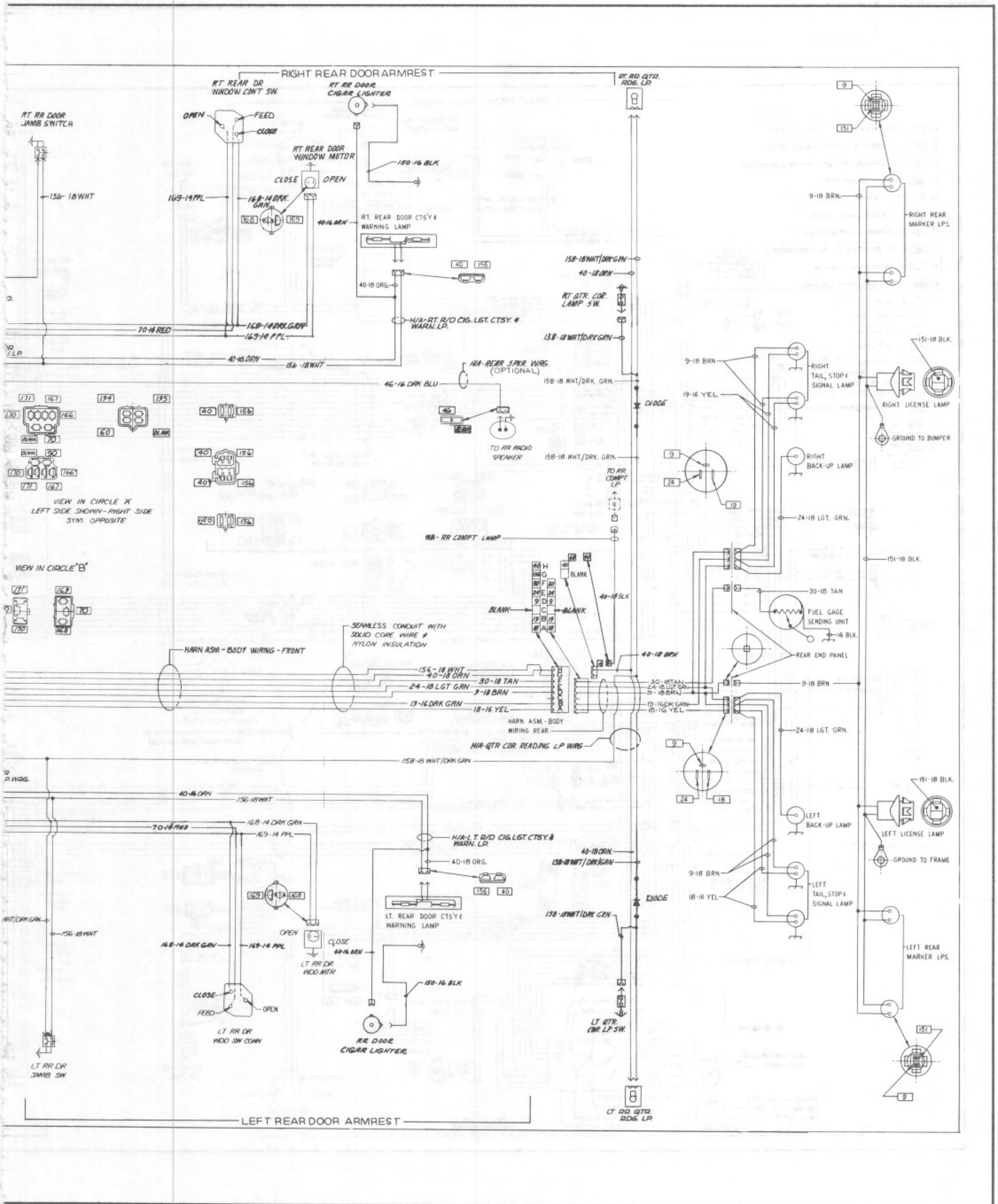


Fig. 12-46 Body Wiring Diagram (6B69)

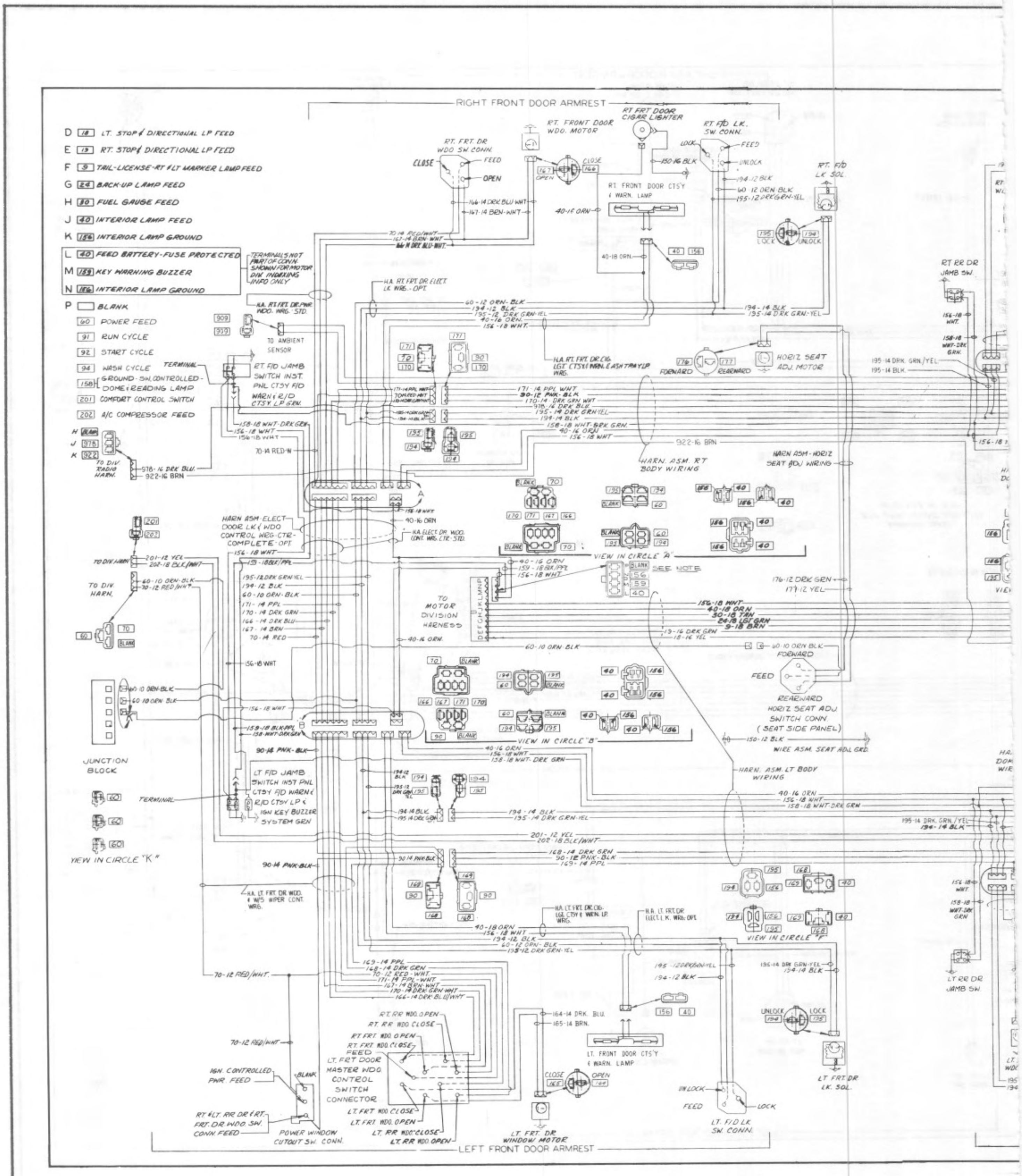


Fig. 12-47 Body Wiring Diagram (6F23)

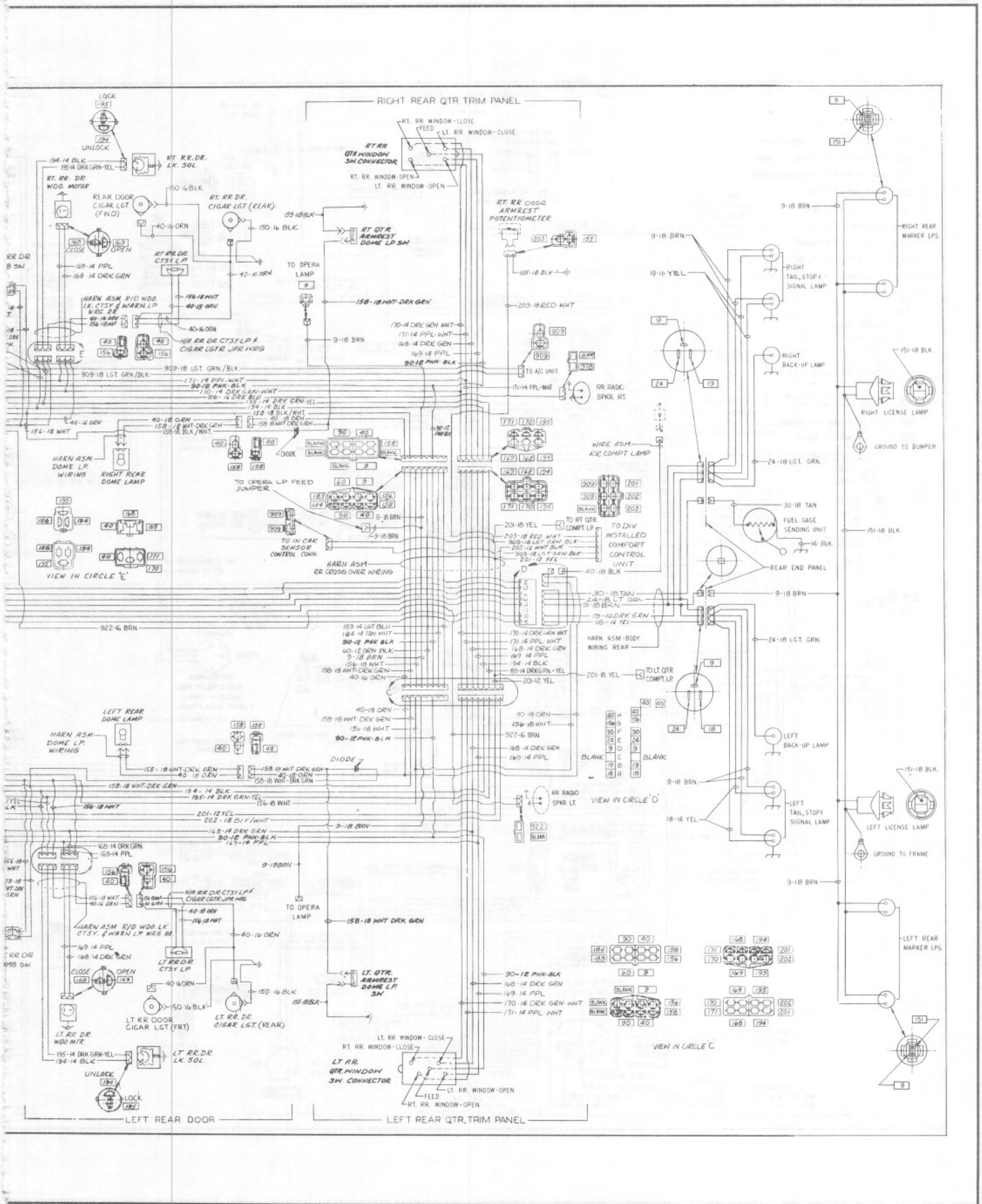


Fig. 12-47 Body Wiring Diagram (6F23)

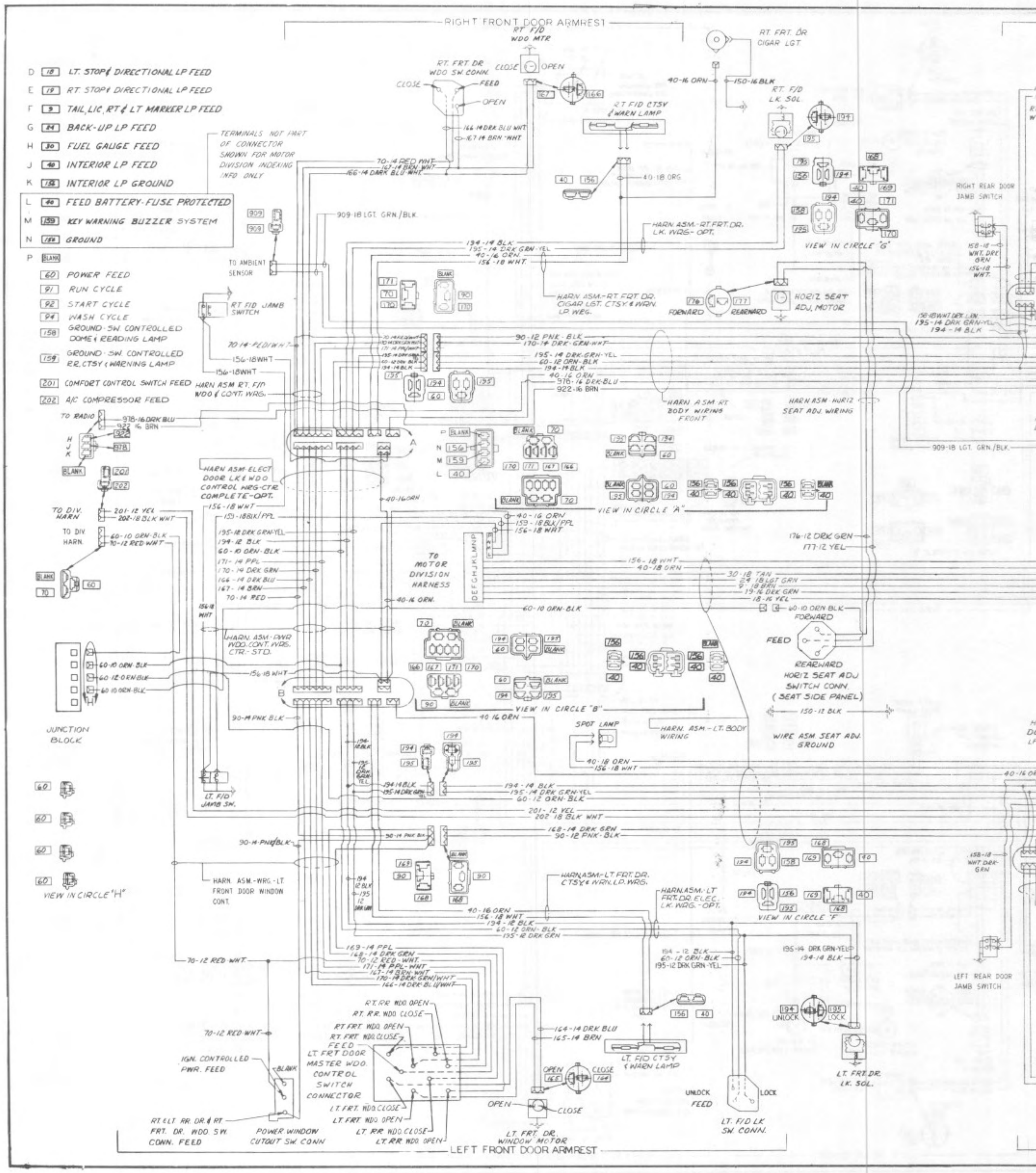


Fig. 12-48 Body Wiring Diagram (6F33)

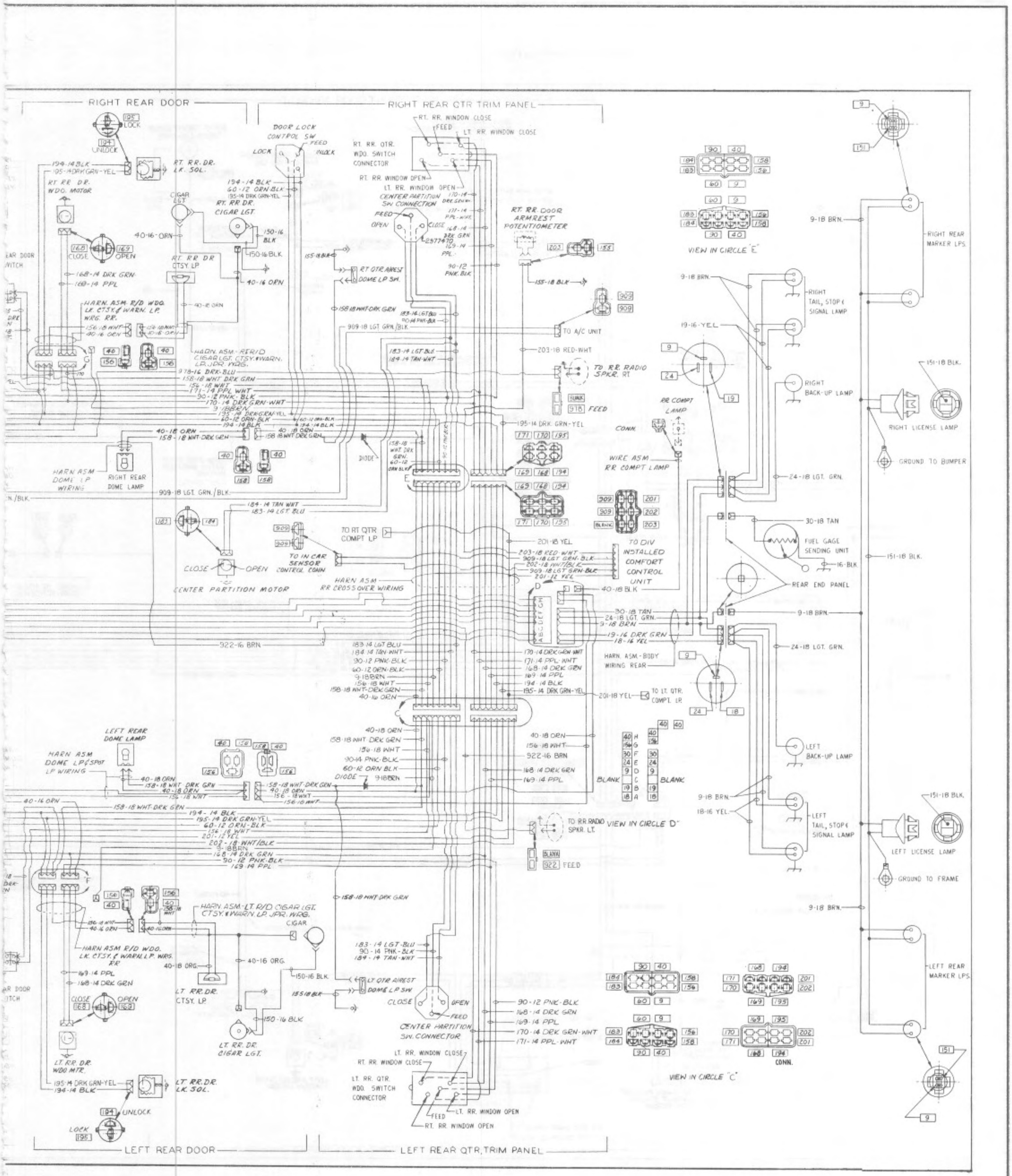


Fig. 12-48 Body Wiring Diagram (6F33)

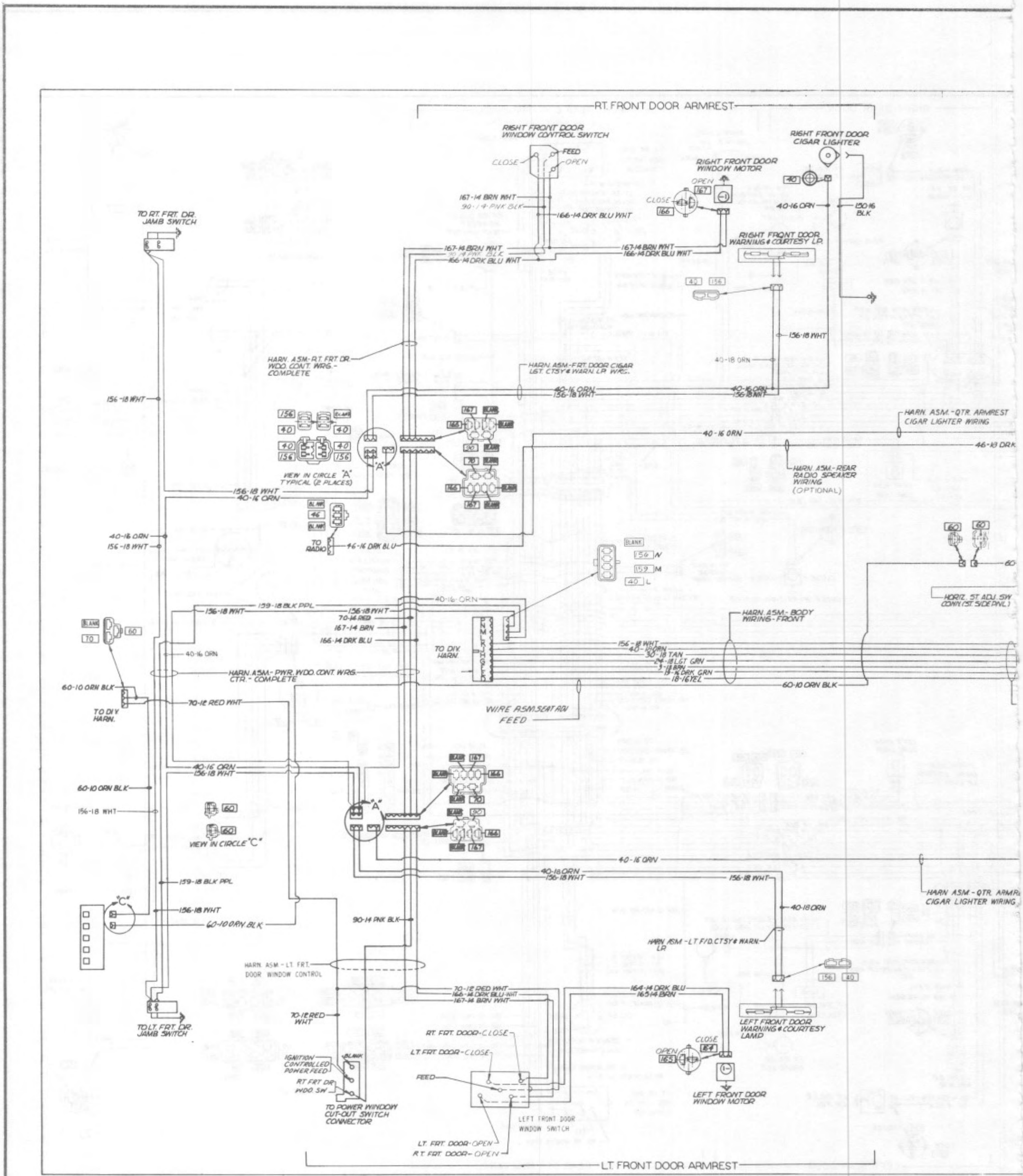


Fig. 12-49 Body Wiring Diagram (6L47)

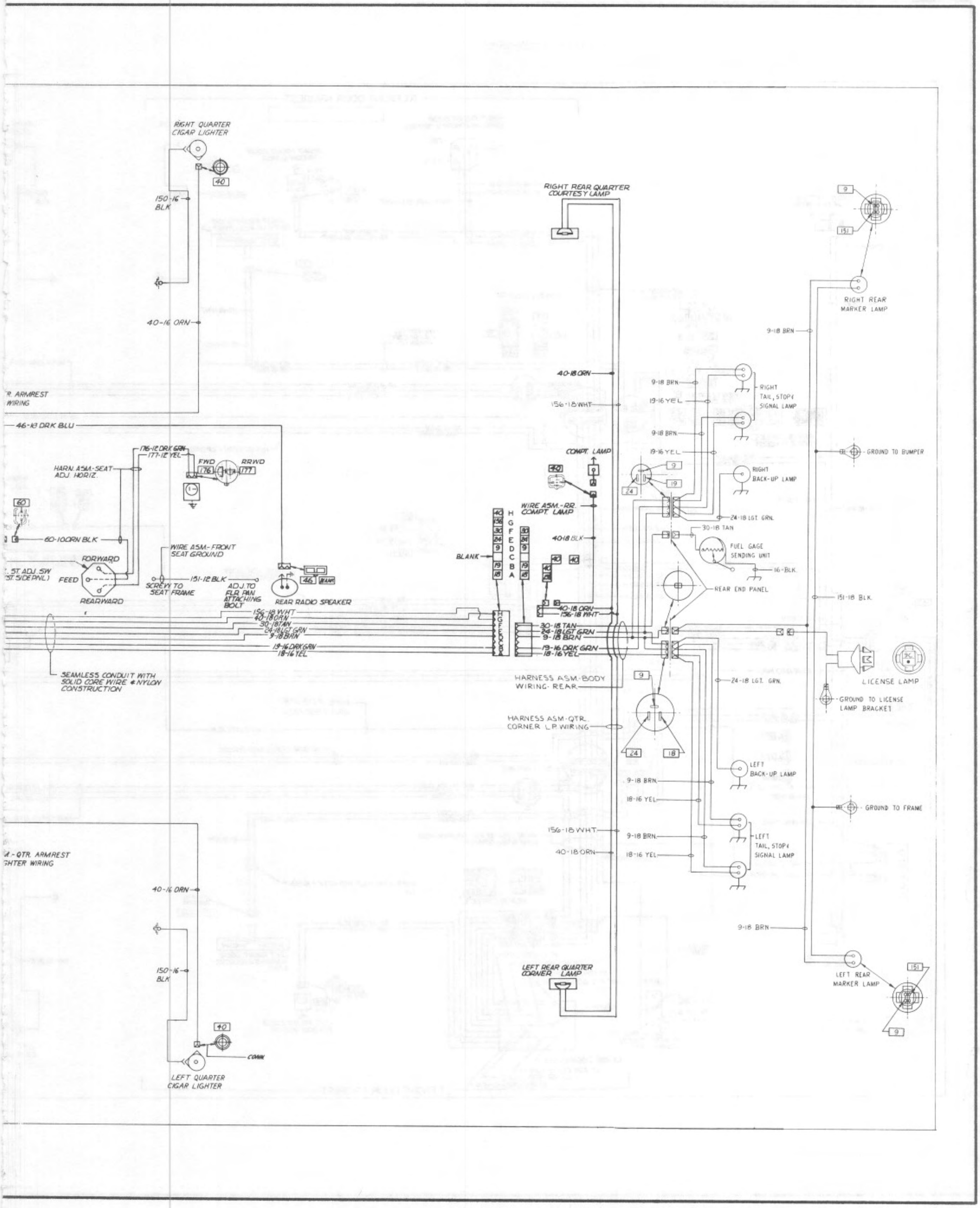


Fig. 12-49 Body Wiring Diagram (6L47)

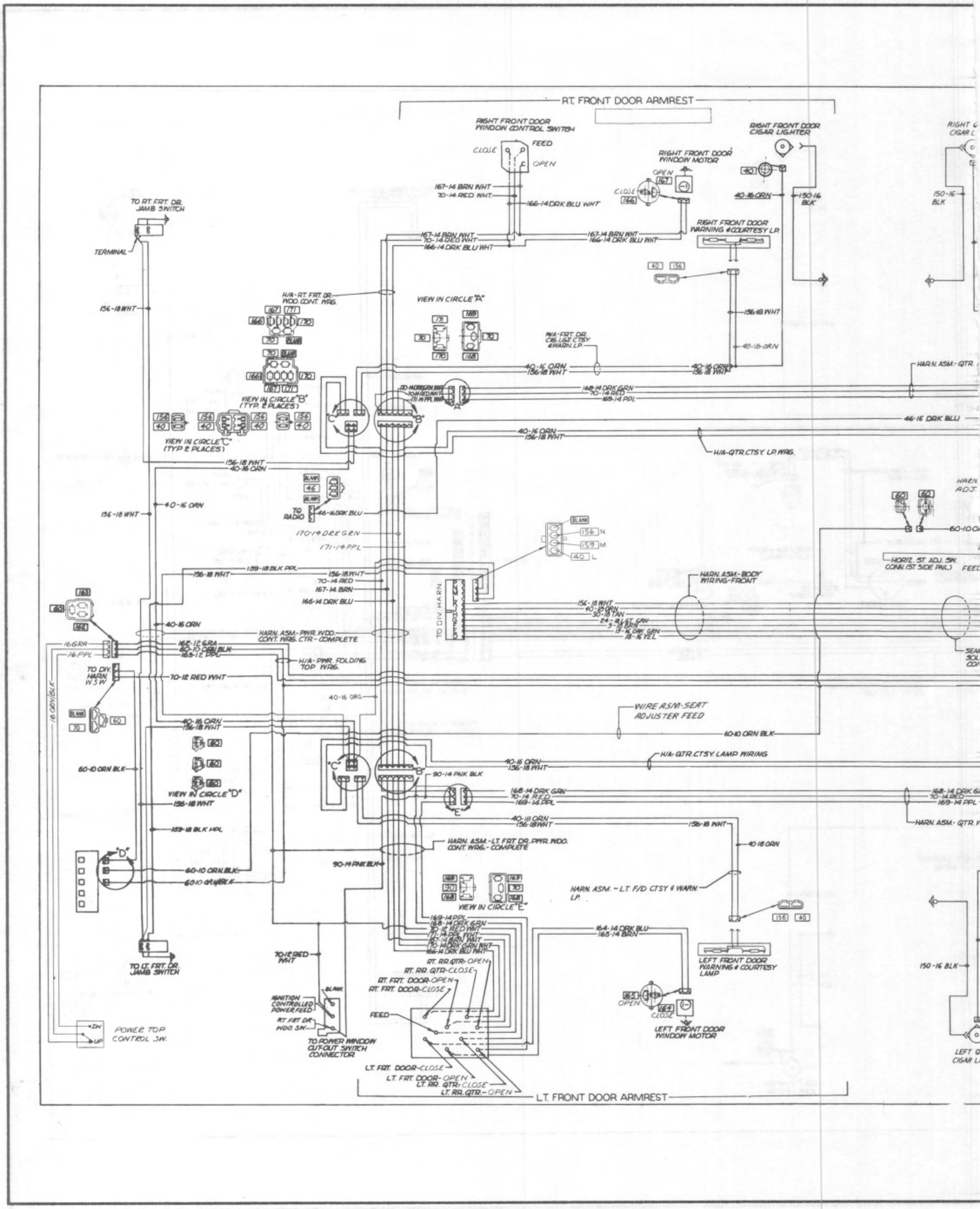


Fig. 12-50 Body Wiring Diagram (6L67)

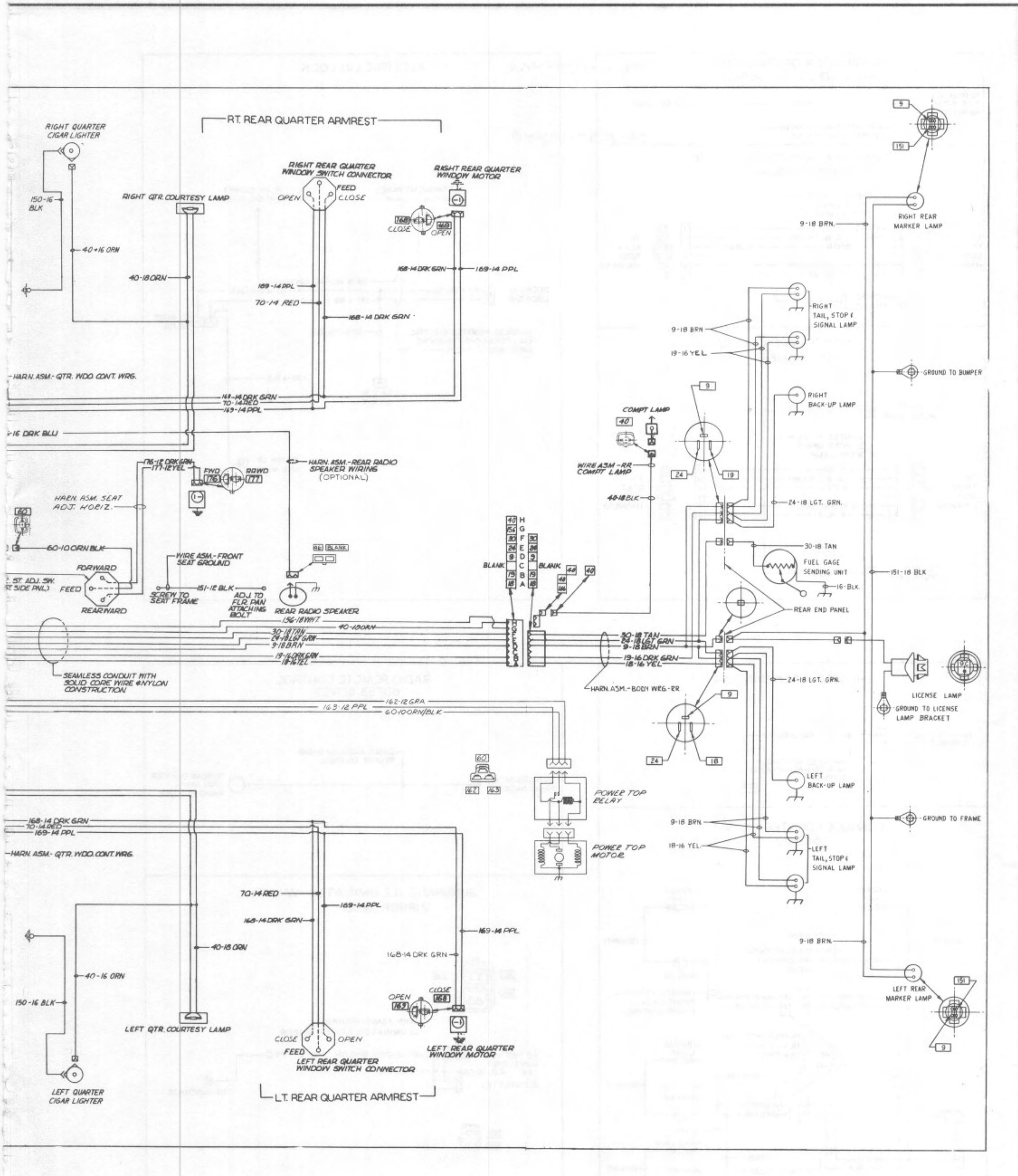


Fig. 12-50 Body Wiring Diagram (6L67)

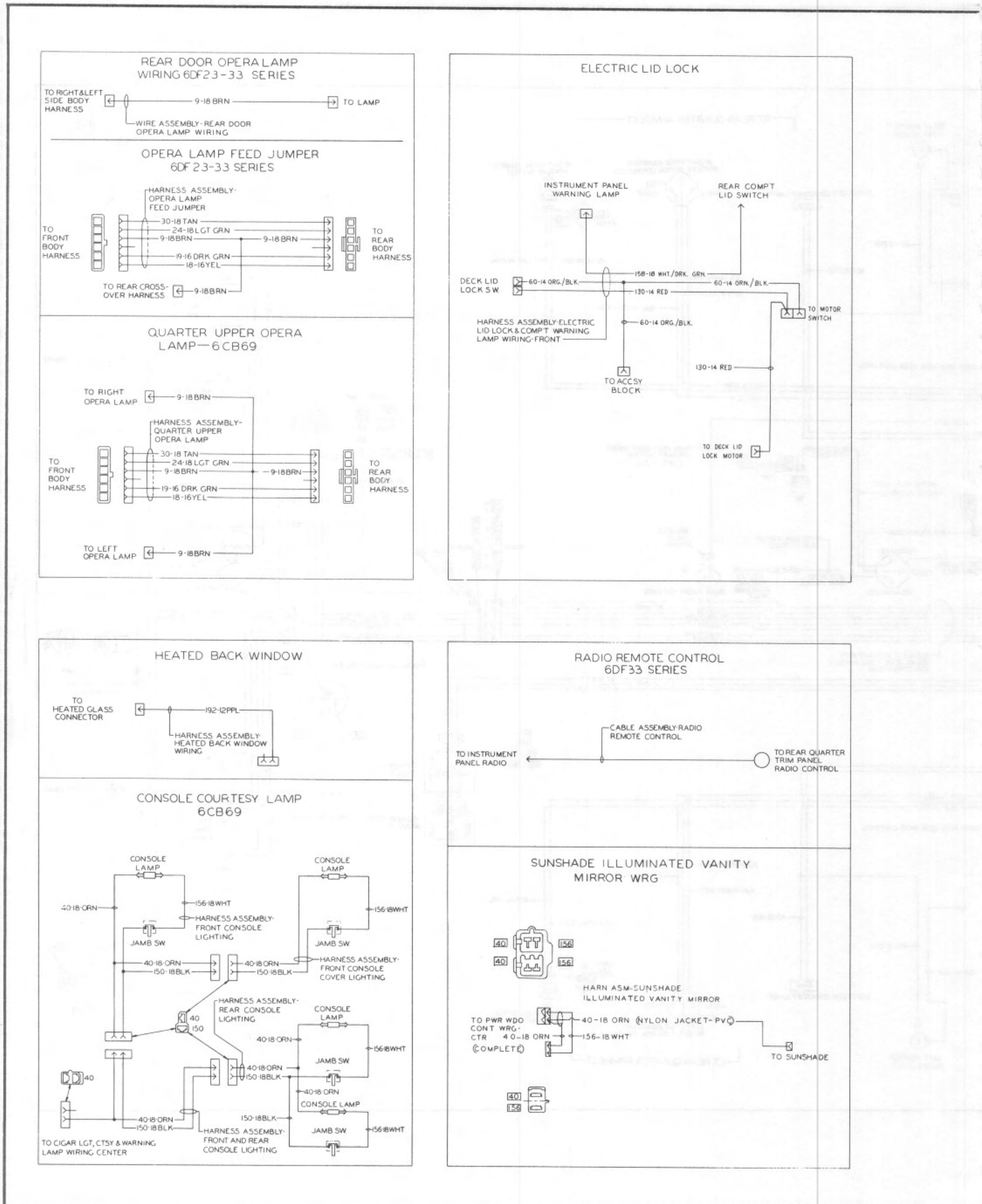


Fig. 12-51 Optional Body Wiring

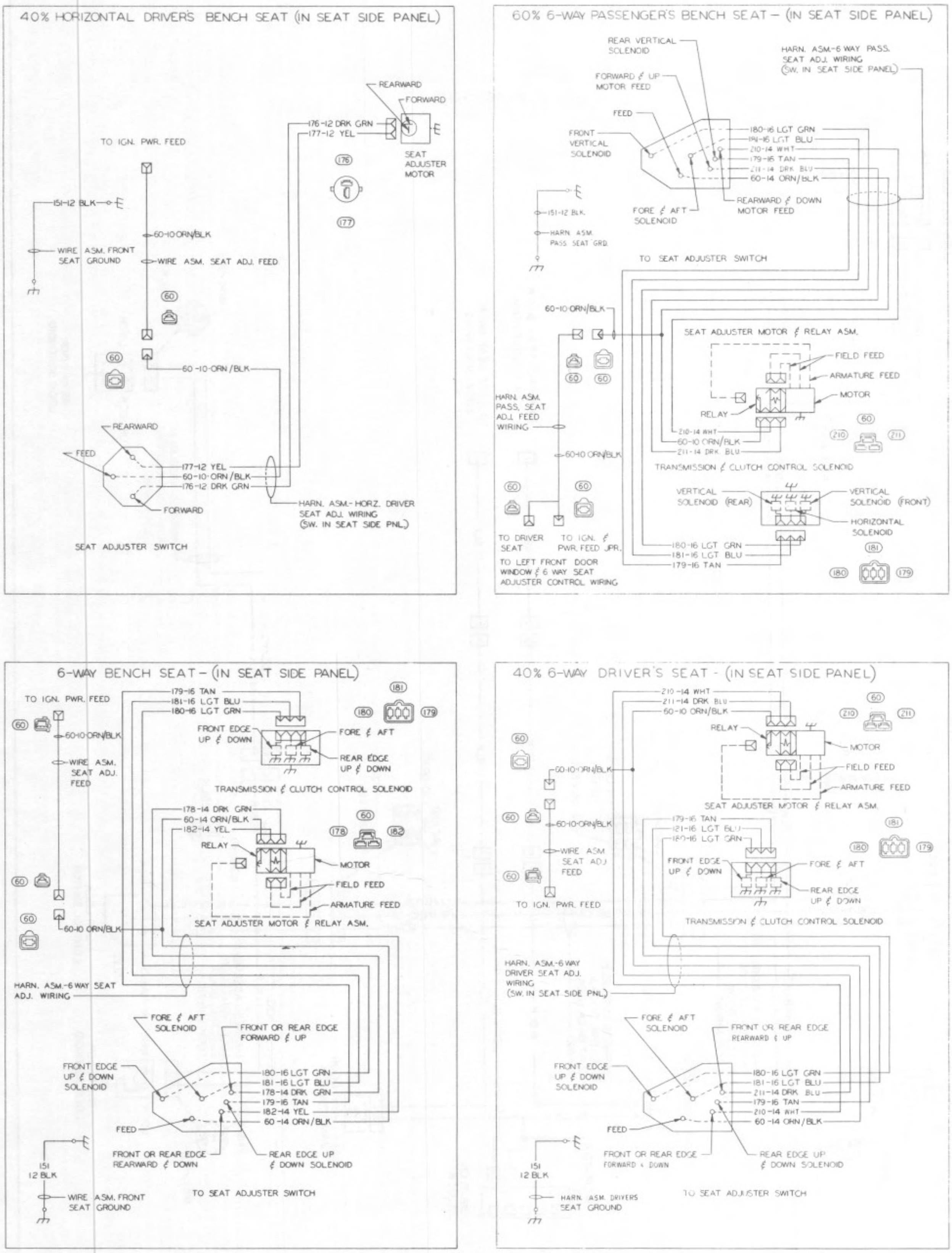


Fig. 12-51 Optional Body Wiring

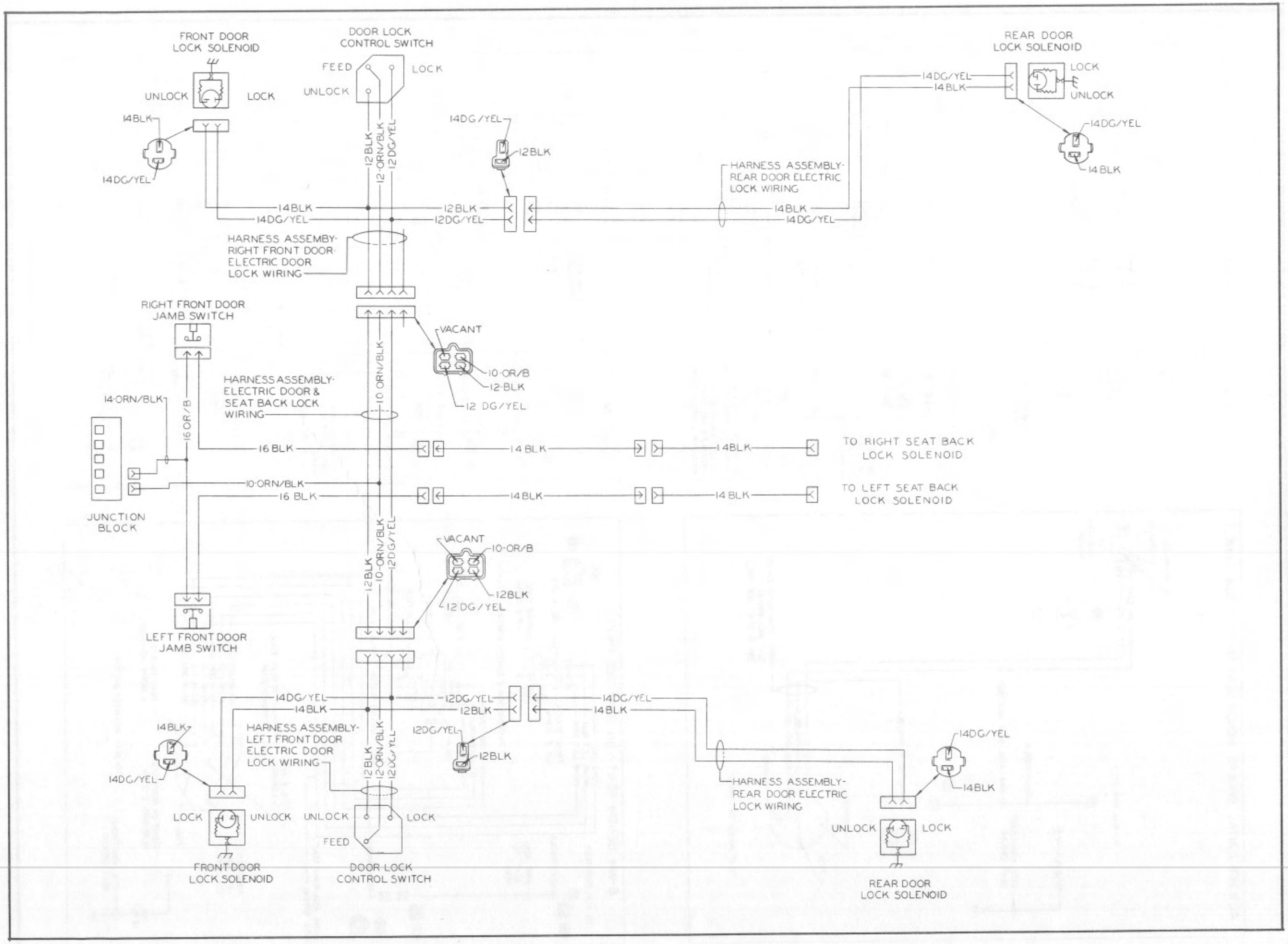


Fig. 12-52 Optional Door Lock and Seat Back Lock Wiring

GENERAL DESCRIPTION

Radiator

A crossflow radiator, Fig. 13-1, is used as part of the engine closed cooling system. The radiator is constructed with two vertical tanks that connect to the enclosed crossflow tubing. The radiator filler neck, vented pressure cap, and coolant reservoir tube are located on the corner of the right tank.

A radiator coolant reservoir is located to the left of the radiator. Service information pertaining to the reservoir is covered in Section 6, Note 4.

Radiator Cradle (Figs. 13-2 and 13-3)

All radiator cradles have an integral fan shroud, and trays on the left and right sides of the radiator to mount the reservoir bottle and the battery, respectively.

A reinforcement strut rod is connected to the tie bar and the bottom of the cradle with two bolts and U-nuts. On all cars except the Eldorado, the cradle is further reinforced by two cross struts that fasten the tie bar at each side of the radiator to the front frame horns. A short length of hose on one of the struts serves to prevent rattling. In addition, strut rods extend forward from each wheelhousing to the radiator cover.

Radiator Cradle Mounts

All cars except the Eldorado use three radiator cradle mounts, Fig. 13-4. The inboard mount attaches directly to the frame front cross member. The two outboard mounts are fastened to the trays on either side of the radiator and are supported by adjustable brackets fastened to the Energy Absorber mounting brackets, Fig. 13-4.

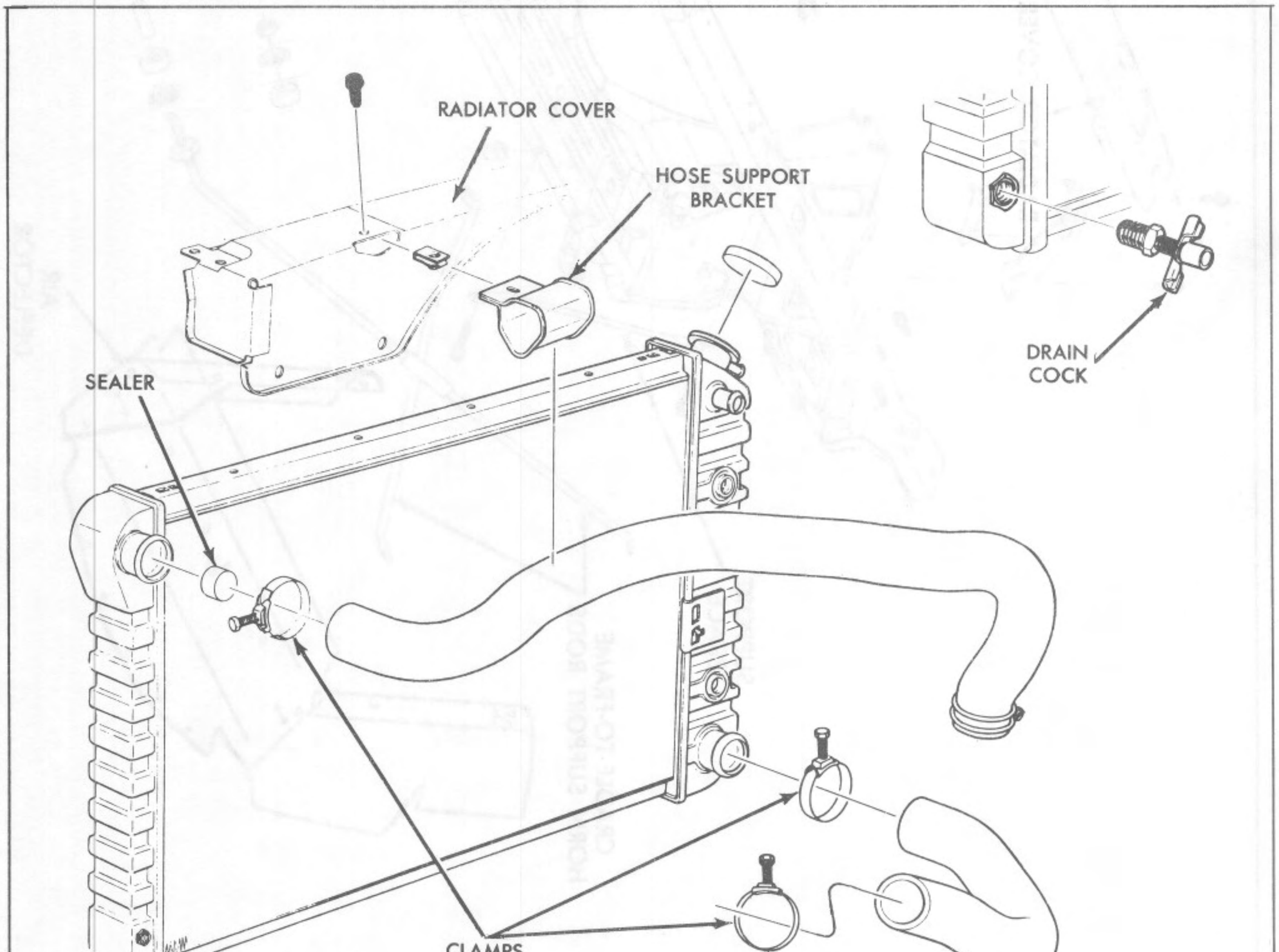


Fig. 13-1 Radiator Assembly and Hoses

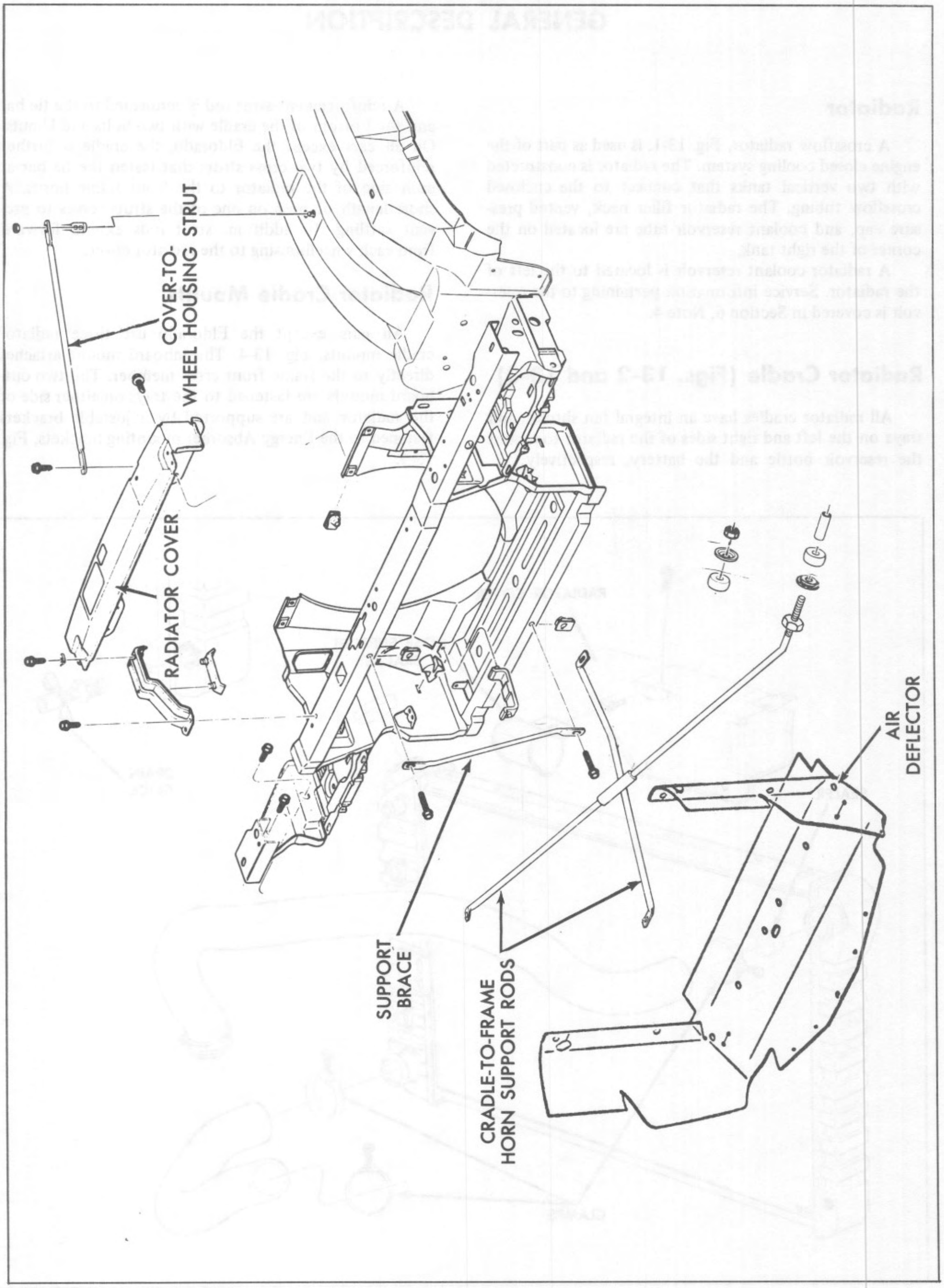


Fig. 13-2 Radiator Craddle Assembly—Except Eldorado

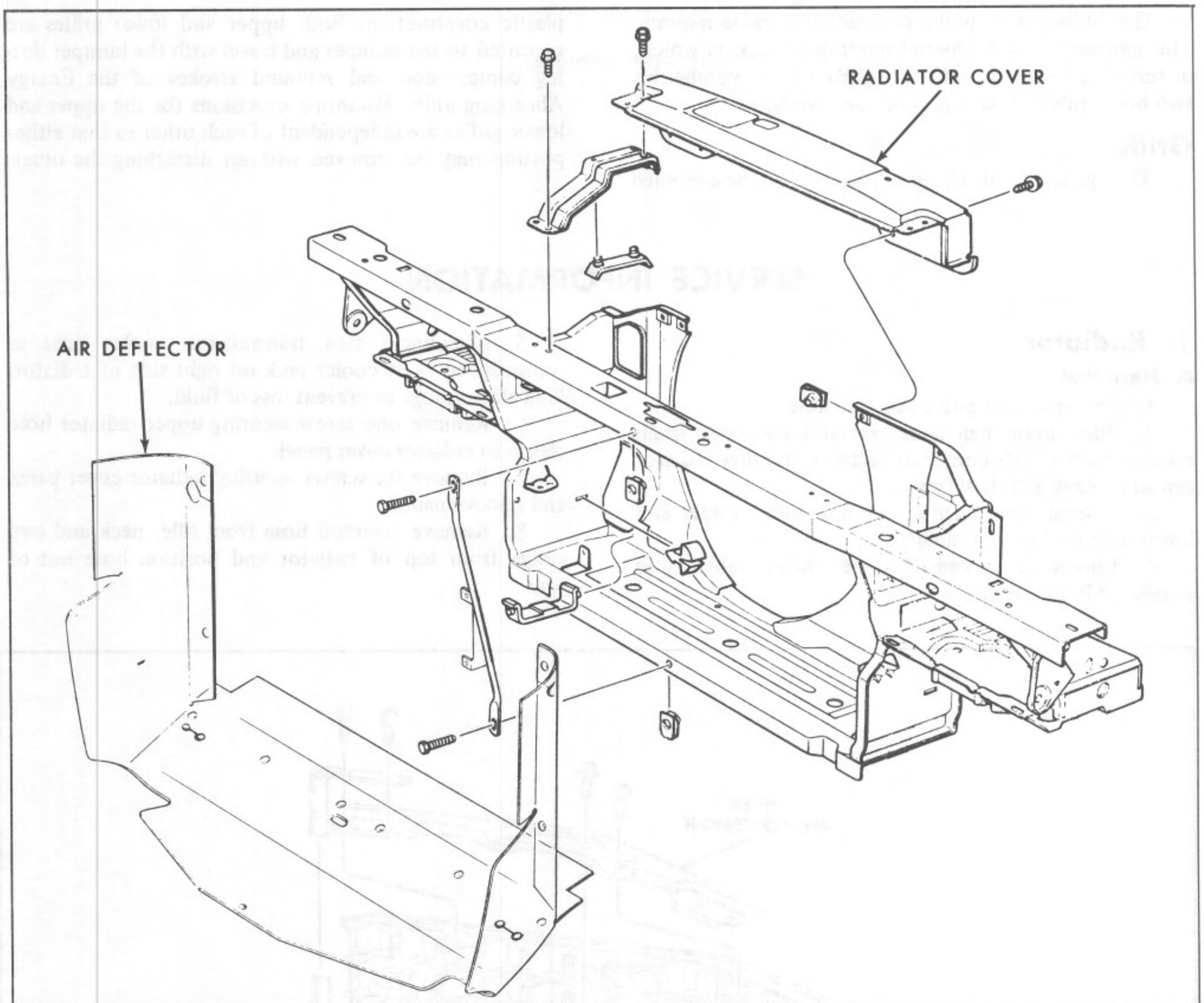


Fig. 13-3 Radiator Cradle Assembly—Eldorado

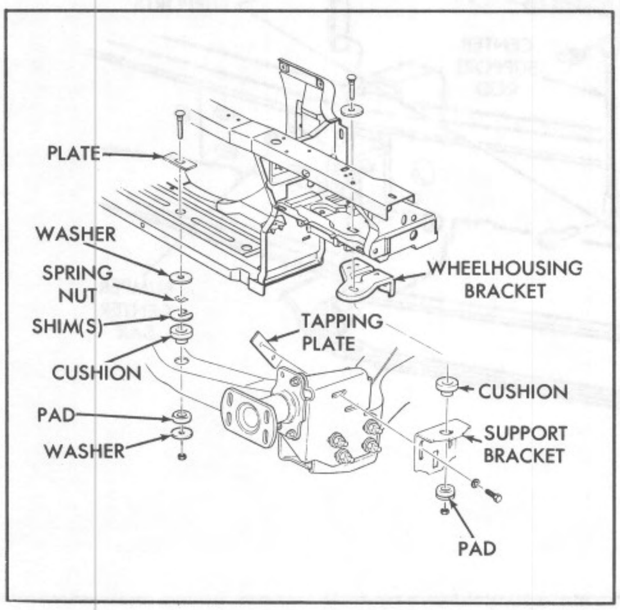


Fig. 13-4 Radiator Cradle Mounts—Except Eldorado

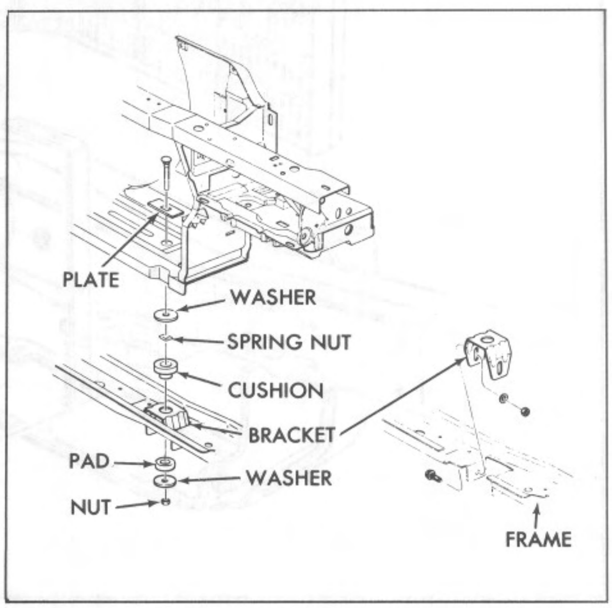


Fig. 13-5 Radiator Cradle Mounts—Eldorado

The Eldorado employs two radiator cradle mounts. The mounts fasten to special mounting brackets which, in turn, are fastened to the frame front cross member by two bolts, rubber bushings, nuts, and washers.

Grille

The grille is of chrome plated, injection-molded plastic construction. Both upper and lower grilles are mounted to the bumper and travel with the bumper during compression and rebound strokes of the Energy Absorbing units. Mounting provisions for the upper and lower grilles are independent of each other so that either portion may be removed without disturbing the other.

SERVICE INFORMATION

1. Radiator

a. Removal

1. Disconnect negative battery cable.
2. Place drain pan under radiator and open drain cock at bottom left corner of radiator. Remove radiator cap so coolant will flow freely.
3. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator.
4. Loosen clamp and disconnect heater return hose at right radiator tank.
5. Disconnect two transmission cooler lines at transmission fluid cooler tank on right side of radiator. Plug all openings to prevent loss of fluid.
6. Remove one screw securing upper radiator hose clamp to radiator cover panel.
7. Remove six screws securing radiator cover panel and remove panel.
8. Remove reservoir hose from filler neck and two straps from top of radiator and position hose out of way.

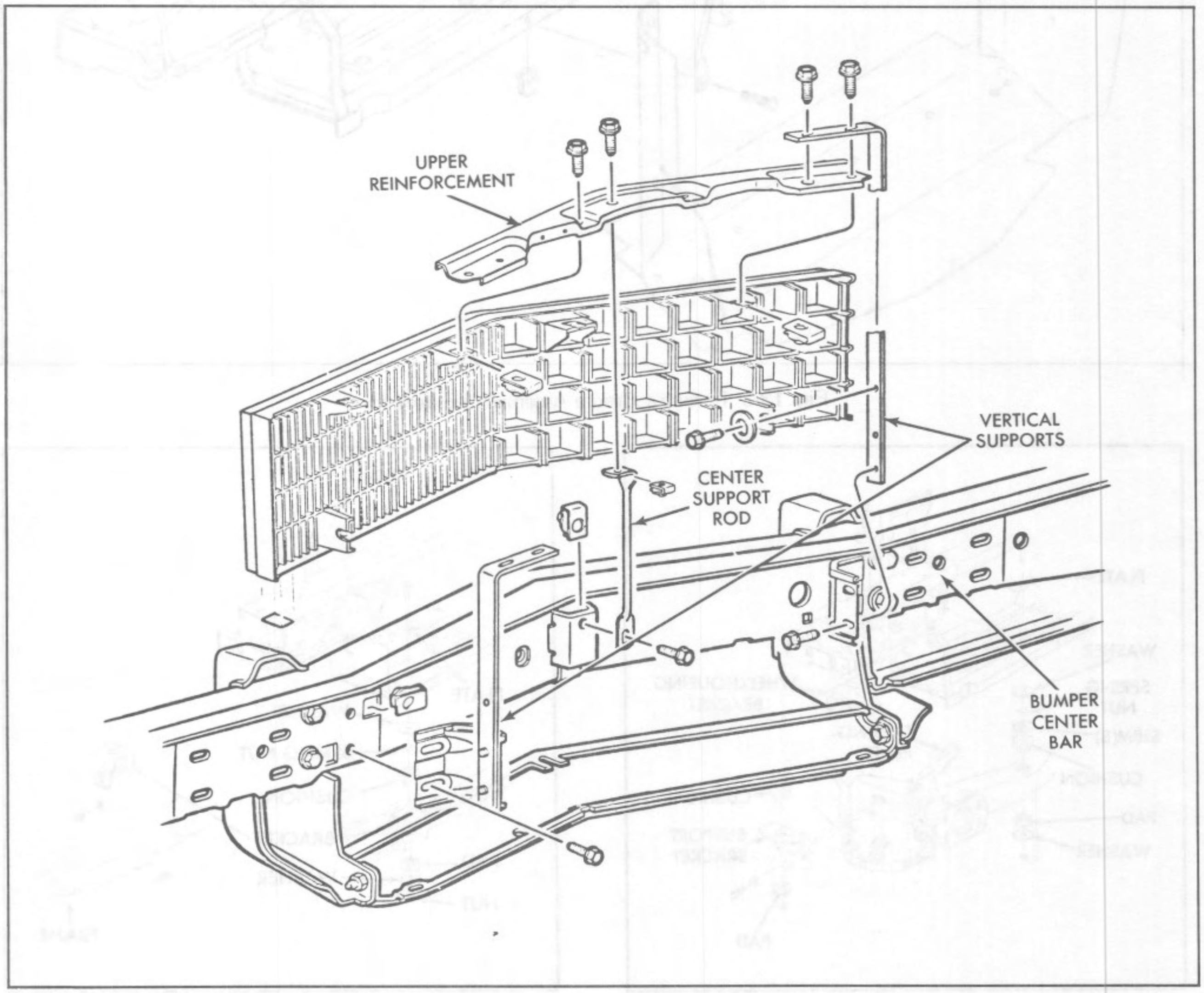


Fig. 13-6 Upper Grille Assembly

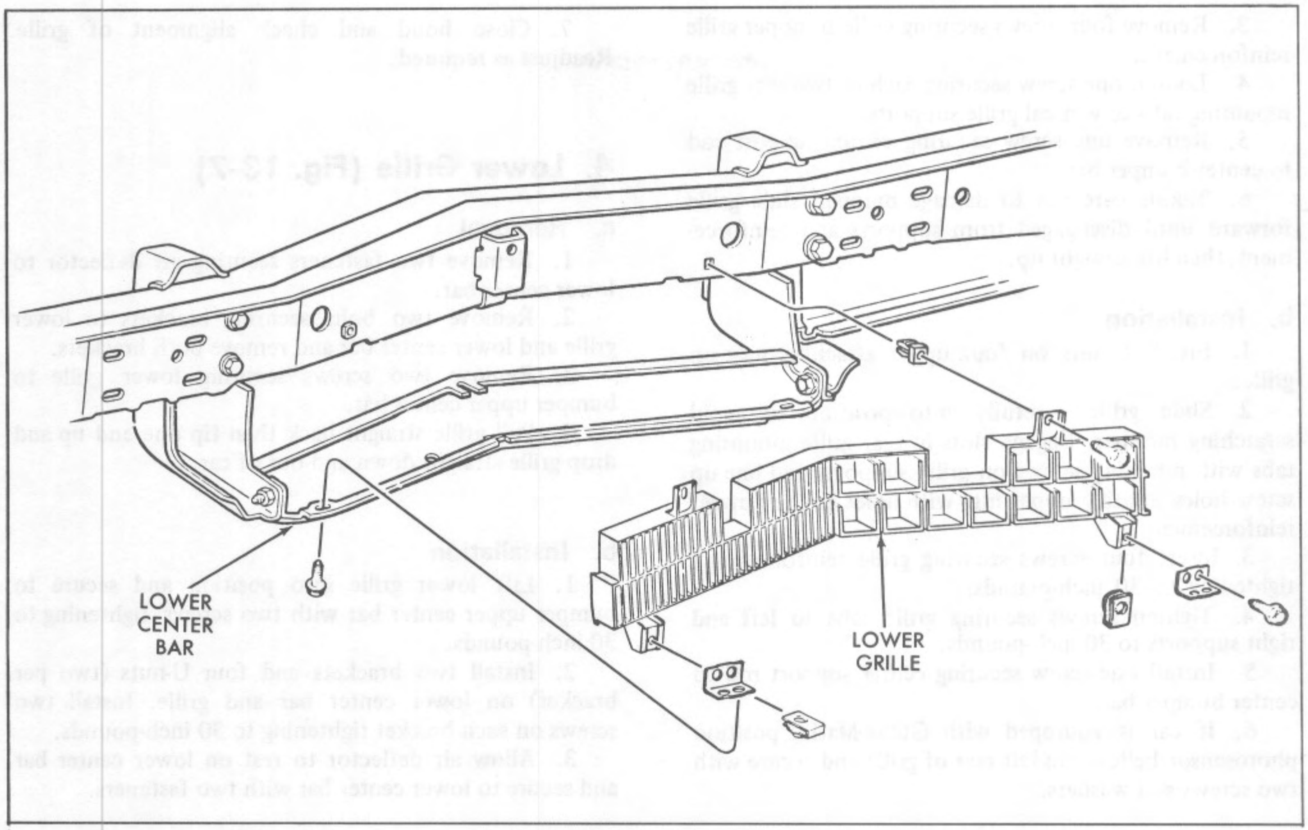


Fig. 13-7 Lower Grille Assembly

9. Being careful not to damage radiator, remove radiator by lifting straight up.

b. Installation

1. Carefully lower radiator into position in cradle.
2. Connect reservoir hose to filler neck and install two straps at top of radiator, securing with four screws.
3. Install radiator cover panel and secure with six screws.
4. Install one screw securing upper radiator hose clamp to cover panel.
5. Connect two transmission cooler lines at transmission fluid cooler tank on right side of radiator, tightening to 20 foot-pounds.
6. Connect upper and lower radiator hoses at radiator and secure with hose clamps.
7. Connect heater return hose to right radiator tank.
8. Close radiator drain cock, and fill cooling system with recommended coolant.
9. Connect negative battery cable.
10. Set Automatic Climate Control to "DEF" position and rotate temperature dial to 85°. If car is equipped with heater only, set controls in maximum heat position.
11. Run engine sufficiently to pump coolant through entire system and check radiator and transmission for fluid levels.
12. Install radiator cap and check all connections for leaks.

2. Radiator Cradle Mounts

a. Inboard Mounts

The actual number of shims used may vary with each installation. Use the quantity necessary to fill the gap remaining between the cradle and frame after the mounting pads are installed and the sheet metal aligned. The correct number of shims required may be determined by attempting to rotate the pad between the cradle and the frame. If the pad can be rotated with the fingers, add shims until pad can no longer be rotated.

b. Outboard Mounts

The cradle support brackets adjust vertically on the EA brackets via slotted holes; therefore, no shims are required. Although three slots are provided, only two screws and washers and one tapping plate are used. Third hole makes bracket interchangeable between left and right side of car.

3. Upper Grille (Fig. 13-6)

a. Removal

1. Open hood.
2. Remove two screws and washers securing Guide-Matic photosensor bellows to rear of left side of grille and pull bellows away from grille.

3. Remove four screws securing grille to upper grille reinforcement.

4. Loosen one screw securing each of two rear grille mounting tabs to vertical grille supports.

5. Remove one screw securing center support rod to center bumper bar.

6. Taking care not to damage bumper, slide grille forward until disengaged from supports and reinforcement, then lift straight up.

b. Installation

1. Install U-nuts on four upper attaching lugs on grille.

2. Slide grille carefully into position to avoid scratching bumper. Engage slots in rear grille mounting tabs with retaining screws on grille supports and line up screw holes in grille upper lugs with holes in grille upper reinforcement.

3. Insert four screws securing grille reinforcement, tightening to 30 inch-pounds.

4. Tighten screws securing grille tabs to left and right supports to 30 inch-pounds.

5. Install one screw securing center support rod to center bumper bar.

6. If car is equipped with Guide-Matic, position photosensor bellows on left rear of grille and secure with two screws and washers.

7. Close hood and check alignment of grille. Readjust as required.

4. Lower Grille (Fig. 13-7)

a. Removal

1. Remove two fasteners securing air deflector to lower center bar.

2. Remove two bolts securing brackets to lower grille and lower center bar and remove both brackets.

3. Remove two screws securing lower grille to bumper upper center bar.

4. Pull grille straight back then tip one end up and drop grille straight down and out of car.

b. Installation

1. Lift lower grille into position and secure to bumper upper center bar with two screws, tightening to 30 inch-pounds.

2. Install two brackets and four U-nuts (two per bracket) on lower center bar and grille. Install two screws on each bracket tightening to 30 inch-pounds.

3. Allow air deflector to rest on lower center bar and secure to lower center bar with two fasteners.

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
275M/1050-65	Lower Grille Angle Bracket to Lower Center Bar Screws	1/4-20	60 in. lb.
275M/1050-65	Angle Bracket to Lower Grille Screws	1/4-20	30 in. lb.
6010M/1008	Lower Grille to Bumper Center Bar Screws	1/4-14	30 in. lb.
275M	Upper Grille Reinforcement to Upper Grille Screws	1/4-20	30 in. lb.
6010M/1050-65	Upper Grille Reinforcement to Support Screws	1/4-20	60 in. lb.
275M	Upper Center Support Rod Screws	1/4-20	60 in. lb.
6010M/1050-65	Upper Grille Support Angle Bracket Screws	1/4-20	60 in. lb.
275M/1050-65	Lower Center Support Rod Screws	5/16-18	18 ft. lb.
286M	Radiator Cradle Mount Nuts	7/16-14	30 ft. lb.
280M	Radiator Cradle Outer Mounting Bracket to EA Bracket	3/8-16	30 ft. lb.
286M	Bumper Outer End Support Rod Nut Eldorado, "75" and Commercial	3/8-16	18 ft. lb.
275M/1050	Radiator Cradle Cross Rod Screws	5/16-18	18 ft. lb.
275M/1050-65	Radiator Cradle Center Support Rod Screws	5/16-18	18 ft. lb.
6010/1050-65	Radiator Cover Strut Rod Screw	5/16-18	18 ft. lb.

GENERAL DESCRIPTION

(NOTE: For additional information pertaining to Eldorado bumpers, refer to the latter portion of this section.)

The Cadillac front bumper assembly, Fig. 14-1, consists of ten pieces: a center bar, two removable bumper guards, two lower license guards, a lower center bar, and upper and lower outer ends on each side. Impact strips on the center bar, bumper guards, and upper outer ends protect the assembly.

Cadillac passenger car bumpers are designed so that the vehicle can withstand a collision into a fixed barrier (at 5 mph) without damage. After absorbing the energy of the collision the bumpers restore themselves to their original position.

The absorbing capability for both front and rear bumper systems is achieved through two energy absorbing devices in each bumper. These units convert the energy of an impact into heat and restoration.

The Energy Absorbing Device consists of two main sub-assemblies; the piston tube assembly and the cylinder tube assembly, Fig. 14-2. The piston tube assembly is filled with an inert gas under pressure and consists of a bumper bracket, piston tube, orifice, seal, piston seal, piston, and stop-ring. The cylinder tube assembly is filled with a hydraulic fluid and consists of a frame bracket, cylinder tube, mounting stud, and metering pin.

The piston tube assembly is inserted in the cylinder tube assembly and the cylinder tube is crimped. This crimp mates with the stop-ring to hold the unit together. The recess in the stop-ring area is filled with grease to prevent the entrance of water and other contaminating materials.

The gas pressure in the piston tube assembly maintains the unit in an extended position. Extension is limited by the stop-ring on the outside of the piston tube engaging the matching contour of the crimp on the cylinder tube as shown in Fig. 14-3. This engagement is also intended to provide extra rigidity to withstand jacking and towing stresses.

Upon impact, as the energy absorber is collapsed, the hydraulic fluid in the cylinder tube is forced into the piston tube through the orifice, Fig. 14-2. The metering pin controls the rate at which this fluid passes from the cylinder tube through the orifice and into the piston tube. This controlled passage of the fluid provides the energy absorbing action.

The hydraulic fluid that is forced from the cylinder tube into the piston tube displaces the floating piston, compressing the gas behind the floating piston. After

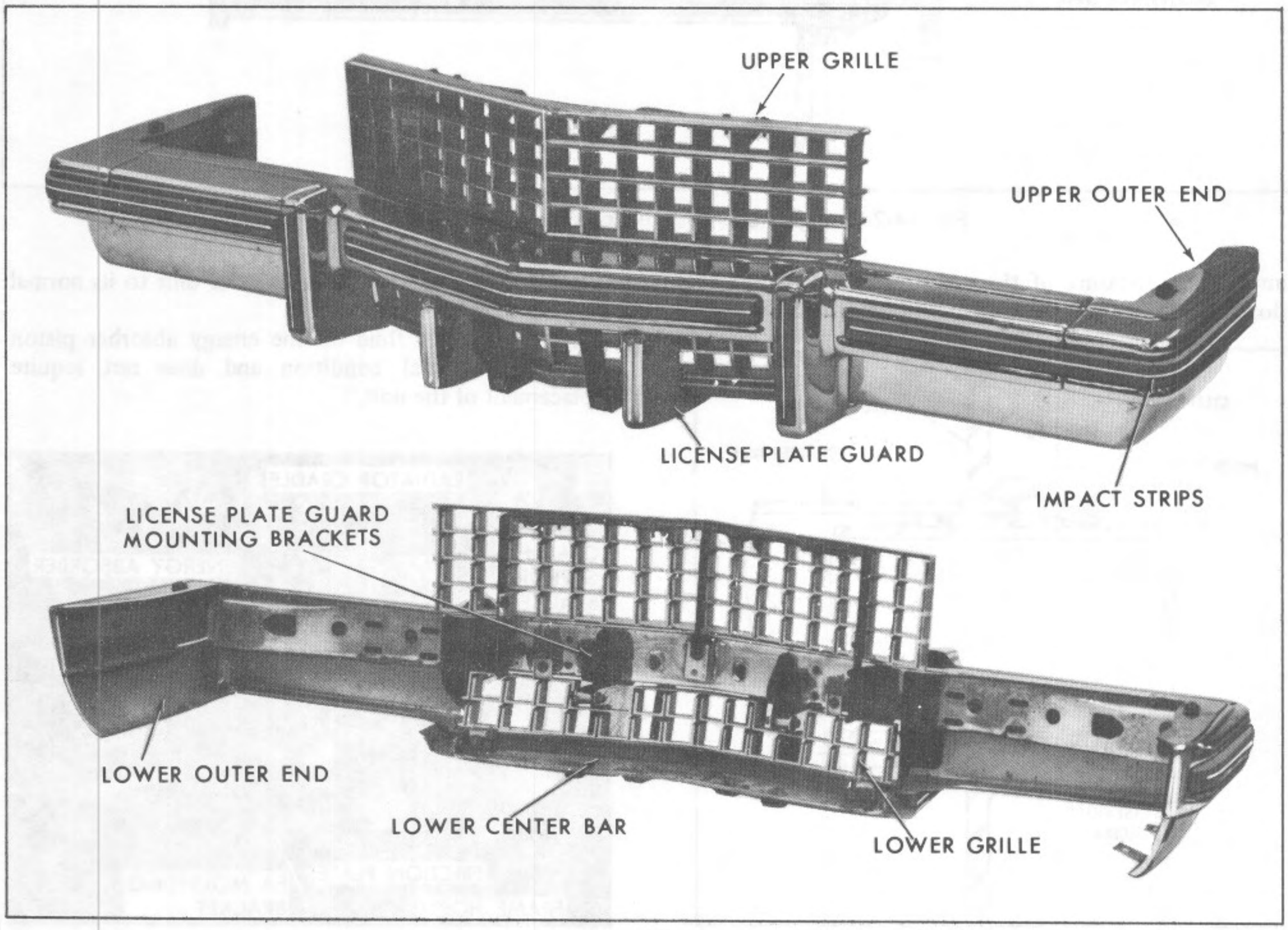


Fig. 14-1 Front Bumper Assembly—Except Eldorado

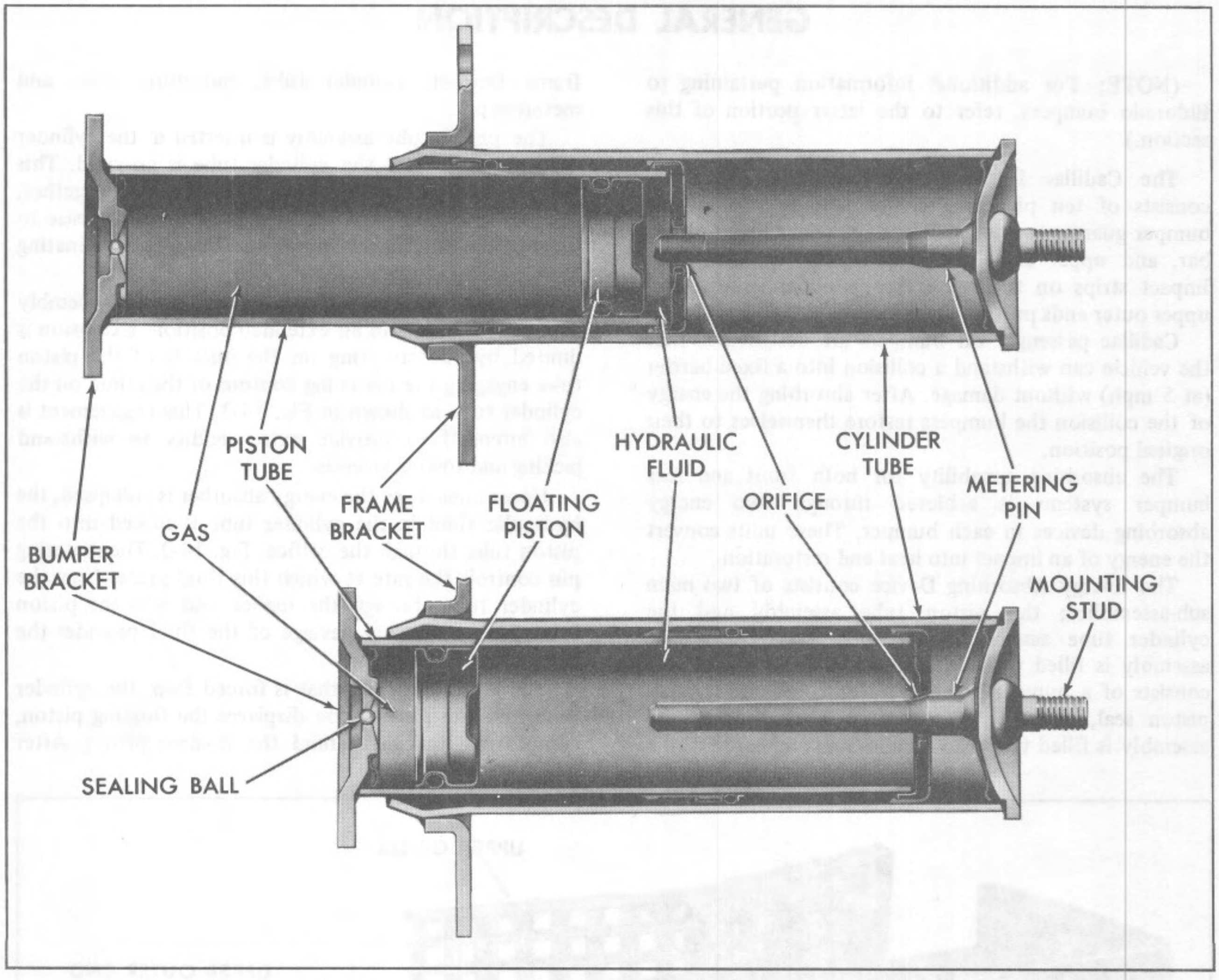


Fig. 14-2 Energy Absorbing Device Extended and Collapsed

impact, the pressure of the compressed gas behind the floating piston forces the hydraulic fluid back into the cylinder tube assembly extending the unit to its normal position.

A thin film of fluid on the energy absorber piston tube is a normal condition and does not require replacement of the unit.

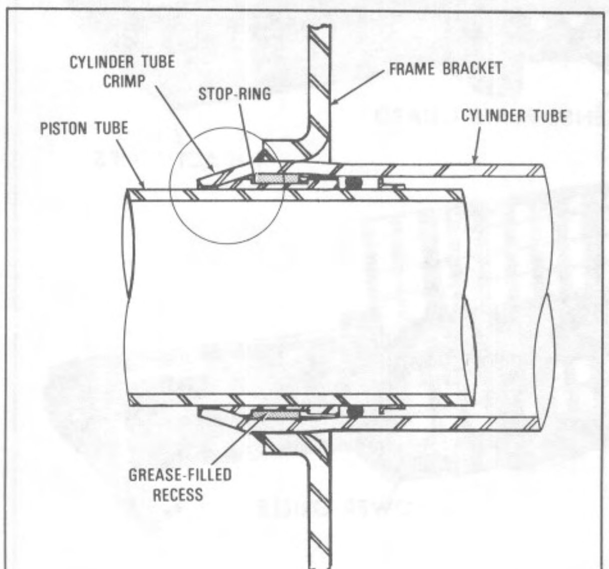


Fig. 14-3 Energy Absorber Crimp Area

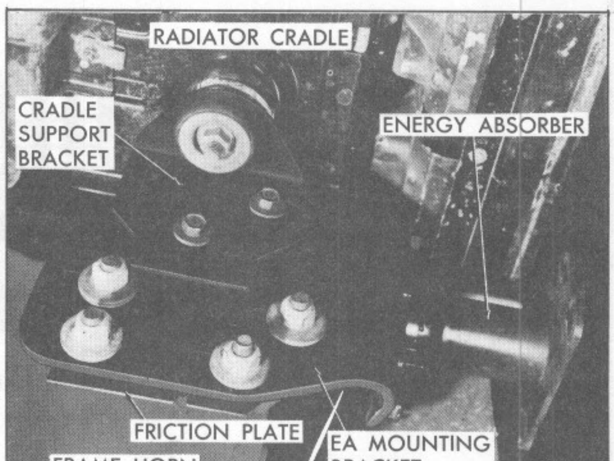


Fig. 14-4 Energy Absorber and Mounting Bracket

Also attached to the bumper is a two piece grille that travels with the bumper when it absorbs an impact. Attachment to the frame is made by means of the Energy Absorbing Devices and their mounting brackets, Fig. 14-4.

On all cars, except Eldorado, two rubber mounted support rods extend downward from the fender reinforcement to a tab on the front bumper outer ends.

On Eldorado two rubber mounted support rods extend downward from the fender catwalk reinforcement to support brackets that attach to the front bumper upper outer ends.

The rear bumper consists of one main bar with detachable outer ends. All rear side markers are attached to the bumper ends, Fig. 14-5. Impact strips protect the assembly through virtually the entire width.

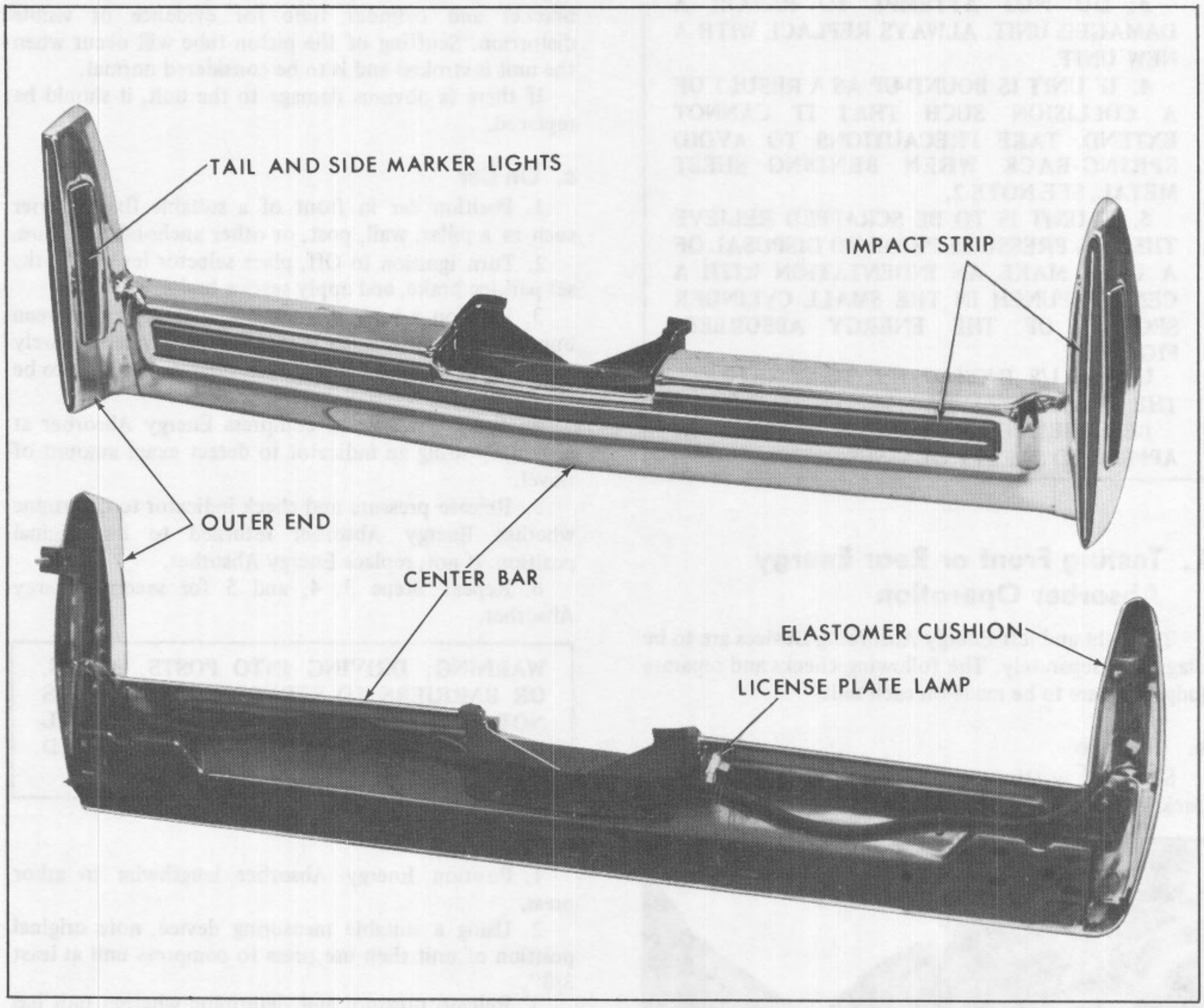


Fig. 14-5 Rear Bumper Assembly—Except Eldorado

SERVICE INFORMATION

WARNING: HEED THE FOLLOWING WHEN HANDLING ENERGY ABSORBING DEVICES OR PERSONAL INDURY MAY RESULT.

1. DO NOT APPLY HEAT TO A UNIT.

2. DO NOT WELD IN THE AREA OF A UNIT.

3. DO NOT ATTEMPT TO REPAIR A DAMAGED UNIT. ALWAYS REPLACE WITH A NEW UNIT.

4. IF UNIT IS BOUND-UP AS A RESULT OF A COLLISION SUCH THAT IT CANNOT EXTEND, TAKE PRECAUTIONS TO AVOID SPRING-BACK WHEN BENDING SHEET METAL. SEE NOTE 2.

5. IF UNIT IS TO BE SCRAPPED RELIEVE THE GAS PRESSURE PRIOR TO DISPOSAL OF A UNIT. MAKE AN INDENTATION WITH A CENTER PUNCH IN THE SMALL CYLINDER SECTION OF THE ENERGY ABSORBER, FIG. 14-6.

USE A 1/8 INCH DRILL TO PENETRATE THE SMALL CYLINDER WALL.

BE SAFE! PROTECT YOUR EYES. WEAR APPROVED SAFETY GLASSES.

1. Testing Front or Rear Energy Absorber Operation

The right and left Energy Absorbing Devices are to be diagnosed separately. The following checks and separate judgments are to be made on each unit:

a. Leakage

Some oil wetting may be visible due to the grease packed in the crimp recess. Therefore, a stain or trace of oil on the piston tube near the crimp is normal. However, if oil is dripping continuously from the crimp or the stud end of the unit, a leak is indicated and the unit should be replaced.

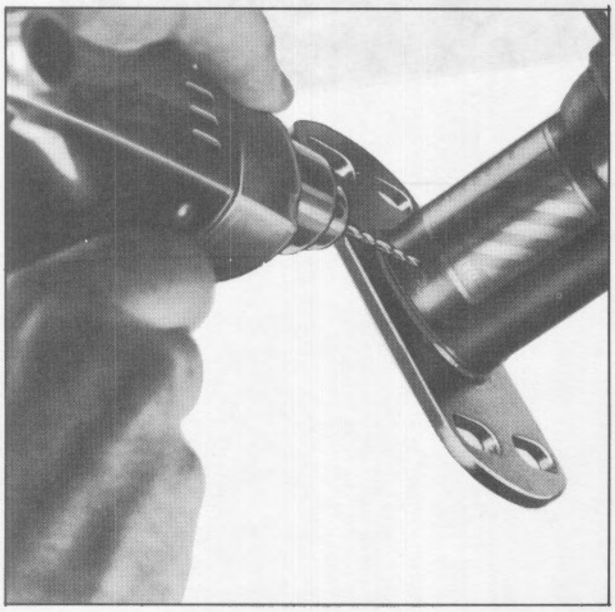


Fig. 14-6 Scrapping Energy Absorber

b. Damage

Observe the bumper bracket, piston tube, frame bracket and cylinder tube for evidence of visible distortion. Scuffing of the piston tube will occur when the unit is stroked and is to be considered normal.

If there is obvious damage to the unit, it should be replaced.

c. On Car

1. Position car in front of a suitable fixed barrier such as a pillar, wall, post, or other anchorable fixture.
2. Turn ignition to Off, place selector lever in Park, set parking brake, and apply service brake.
3. Position a hydraulic or mechanical jack between bumper and barrier such that jack is positioned squarely with bumper directly in line with Energy Absorber to be checked.
4. Apply pressure to compress Energy Absorber at least 3/8" using an indicator to detect exact amount of travel.
5. Release pressure and check indicator to determine whether Energy Absorber returned to its original position. If not, replace Energy Absorber.
6. Repeat Steps 3, 4, and 5 for second Energy Absorber.

WARNING: DRIVING INTO POSTS, WALLS, OR BARRIERS TO PERFORM THIS TEST IS NOT RECOMMENDED BECAUSE PERSONAL INJURY OR PROPERTY DAMAGE COULD RESULT.

d. On Bench

1. Position Energy Absorber lengthwise in arbor press.
2. Using a suitable measuring device, note original position of unit then use press to compress unit at least 3/8".
3. Release pressure and determine whether unit has returned to original position. If not, discard unit.

2. Inspection After Collision

If the collision was so severe that the bumper did not return to its original position, the energy absorber(s) will require replacing.

1. Stand clear of the bumper.
2. Provide a positive restraint, such as a chain or cable to hold the bumper in the position it is in.
3. Wear safety glasses and drill a small hole in the piston tube near the bumper bracket, Fig. 14-6, to relieve gas pressure.
4. Remove the energy absorber(s) after gas pressure has been relieved.

3. Front Bumper

a. Removal

1. Support bumper at center with hydraulic jack. If car is equipped with Guide-Matic, remove two screws securing photosensor bellows to left side of upper grille and disconnect bellows.

2. Remove four bolts and two retainers securing bumper to EA unit.

3. Except Eldorado: remove nut securing lower end of support rods to tab on bumper outer ends.

Eldorado: Remove nut, two cushions, two retainers and spacer securing support rod to bracket on bumper end. Do not disturb nut just above upper cushion, as it controls cushion load and position.

4. Open hood and remove two retainers securing air deflector to lower center bar. On all cars except Eldorado, remove one bolt and tapping plate securing wheelhousing splash shield to each rear corner of bumper.

5. Repeat Steps 2 and 3 for other side of car and remove bumper.

b. Installation

1. Raise bumper into position. Make sure center air deflector and filler strips at headlight housings are resting on bumper. Make sure support rods are in tabs or bracket on bumper.

2. Insert two retainers in position behind mounting holes in bumper and install four bolts finger tight securing each EA unit to bumper.

3. Except Eldorado: install nut securing lower end of support rods to tab on bumper outer ends.

Eldorado: install retainer, cushion, spacer, second cushion and retainer, and nut securing each support rod to bumper bracket. Tighten nut to 18 foot-pounds.

4. Repeat Steps 2 and 3 for other side of car.

5. Open hood and install two retainers securing air deflector to lower center bar. Secure Guide-Matic bellows to grille with two screws. On all cars except the Eldorado, install one bolt and tapping plate securing wheelhousing splash shield to each rear corner of bumper.

6. Before tightening, check bumper to assure proper alignment. Vertical and side-to-side adjustments can be made using slotted holes in EA unit and bumper. Tighten bolts to 35 foot-pounds and remove jack.

4. Front Energy Absorbing Unit and Mounting Brackets (Fig. 14-4)

a. Removal

1. Support bumper at center with hydraulic jack.

2. Remove four bolts and washer assemblies and two retainer plates securing EA unit to bumper.

3. Remove four nuts, washers and bolts securing EA bracket and friction plate to frame.

4. Remove two bolts and washers and one tapping plate securing radiator cradle support bracket to EA bracket, if car is so equipped.

5. Rotate radiator cradle support bracket out of way and remove EA unit, mounting bracket, and friction plate as an assembly.

6. Remove three bolts and nuts securing EA unit mounting plate to EA bracket.

7. Remove one nut securing rear of EA unit to EA bracket. Slide EA unit forward and out of bracket.

b. Installation

1. Position EA unit inside mounting bracket and secure to front of bracket with three bolts and nuts, tightening to 55 foot-pounds.

(NOTE: Although there are four mounting holes in the EA unit, only three are used. Upper inboard hole is left blank.)

2. Install nut on EA unit mounting stud, tightening to 55 foot-pounds.

3. Position EA unit, friction plate, and bracket on rear of bumper center bar. Install four bolts and washers and two tapping plates and tighten bolts until snug. Do not torque at this time.

4. Line up holes in frame horn, friction plate, and EA mounting bracket. Install four bolts and nuts with washers so that bolt heads are inside frame horn. Tighten until snug, but do not torque.

5. Examine bumper for proper alignment and adjust as required. Fore and aft adjustment can be made by means of slotted holes in the EA mounting bracket. Vertical and crosscar adjustment is provided by slotted holes in the bumper center bar and the EA unit.

6. When proper alignment is achieved, tighten four bolts securing EA unit to bumper to 35 foot-pounds, and four bolts securing EA mounting bracket to frame to 75 foot-pounds; then remove hydraulic jack.

7. Rotate outboard cradle mount support bracket into position, if car is so equipped. Install two bolts and washers and one tapping plate securing cradle bracket to EA mounting bracket, tightening to 30 foot-pounds. Make sure cradle mount nut is torqued to 30 foot-pounds.

5. Front Bumper Guards and Bumper Guard Impact Strips—On Car (Fig. 14-7)

a. Removal

1. Remove two long screws and washers securing bumper bracket and bumper guard to bumper upper center bar.

2. Remove one bolt and washer assembly and one nut securing guard to bumper lower center bar.

3. Remove one bolt spacer and nut securing bumper guard to lower inner end of lower center bar and remove bumper guard.

4. Remove three nuts securing impact strip to bumper guard and remove impact strip.

b. Installation

1. Install impact strip on bumper guard, securing with three nuts. Tighten nuts to 15 inch-pounds. Do not overtorque or strip may become distorted.

2. Position bumper guard and bumper bracket on bumper. Install two long screws and washers, tightening to 30 foot-pounds.

3. Install one bolt and washer assembly and one nut securing guard to lower center bar, tightening bolt to 18 foot-pounds.

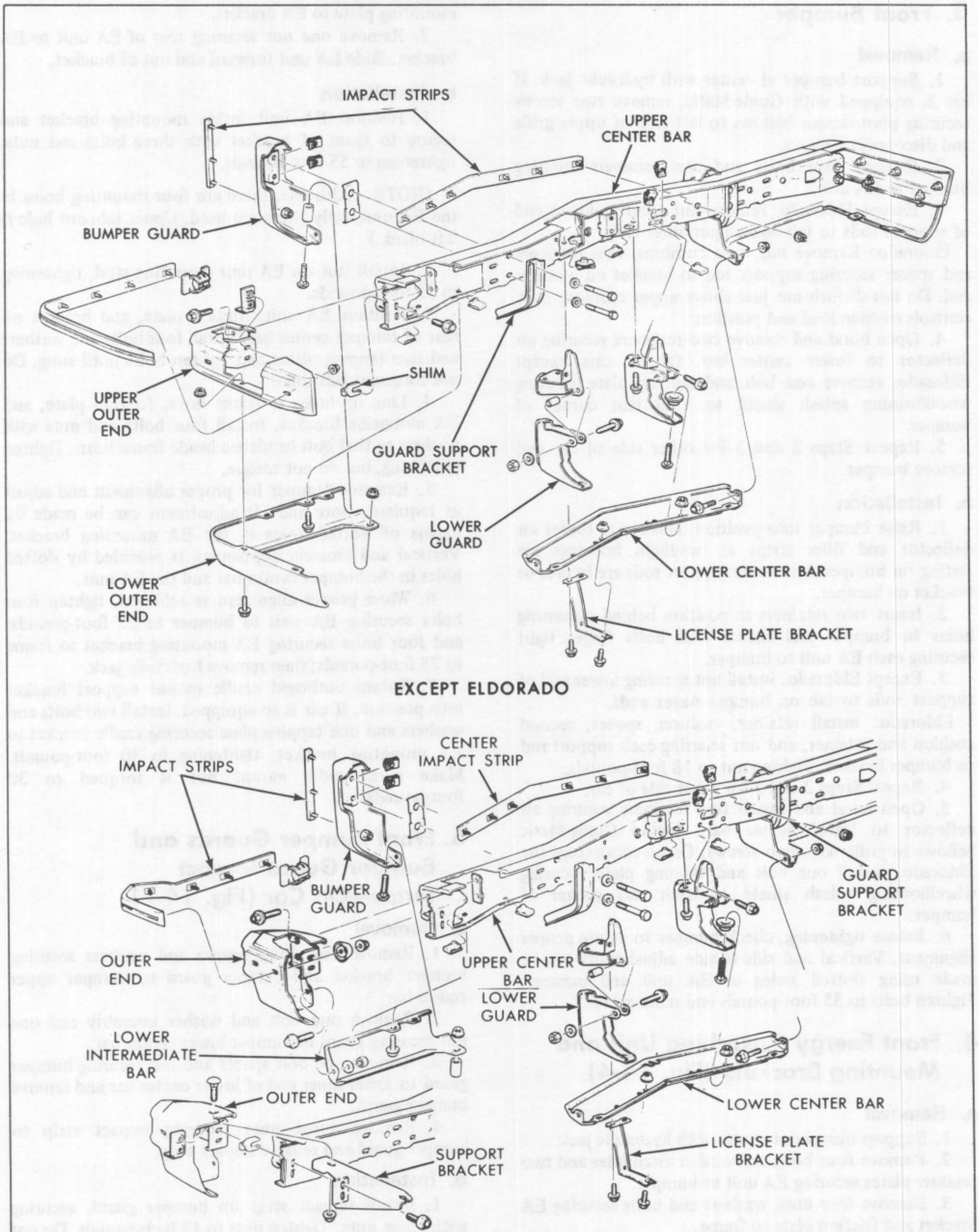


Fig. 14-7 Front Bumper Disassembled

4. Make sure U-nut is in place and install one bolt, spacer and nut securing guard to lower inner end of lower center bar. Tighten to 18 foot-pounds.

6. Front License Plate Bracket (Fig. 14-7)

a. Removal

1. Remove two screws and washer assemblies securing each license bracket to upper and lower center bars and remove brackets.

b. Installation

1. Position brackets to upper and lower center bars and secure with two screw and washer assemblies.

7. Lower Guard (Fig. 14-7)

a. Removal

1. Remove one bolt and washer assembly, spacer and washer and nut securing lower guard to support bracket.
2. Remove one bolt, spacer and nut securing lower guard to lower center bar and remove guard.
3. Remove four bolt and washer assemblies securing lower guard support to upper center bar and remove support bracket.

b. Installation

1. Install bracket to upper center bar, and secure with four bolt and washer assemblies. Tighten to 35 ft. lbs.
2. Position lower guard and install one bolt, spacer and nut securing guard to lower center bar. Tighten to 20 ft. lbs.
3. Install one bolt and washer assembly, spacer and nut securing lower guard to support bracket. Tighten to 35 ft. lbs.

8. Lower Center Bar (Fig. 14-7)

a. Removal

1. Open hood and remove two retainers securing air deflector to lower center bar.
2. Remove one bolt and washer assembly securing each end of lower center bar to its respective bumper guard.
3. Remove two bolt and washer assemblies securing grille to lower mounting brackets and lower center bar.
4. Remove two screw and washer assemblies securing license plate brackets to upper center bar.
5. Remove two screw and washer assemblies securing license plate assembly to lower center bar and remove license plate assembly.
6. Remove two bolts, spacers and nuts securing lower leg of lower guard to lower center bar and remove lower center bar.

b. Installation

1. Position center bar and install two bolts, spacers and nuts securing lower leg of lower guard to lower center bar. Tighten to 20 ft. lbs.
2. Install two screw and washer assemblies securing license plate bracket to lower center bar. Tighten to 60 in. lbs.
3. Install two screw and washer assemblies securing license plate brackets to upper center bar. Tighten to 60 in. lbs.
4. Install two bolt and washer assemblies securing grille to lower mounting brackets and lower center bar. Tighten to 35 in. lbs.
5. Install one bolt and washer assembly securing each end of lower center bar to its respective guard. Tighten to 20 ft. lbs.
6. Install two retainers securing air deflector to lower center bar.

9. Front Bumper Center Impact Strip—On Car (Fig. 14-7)

a. Removal

1. Open hood and, using six access holes in rear of bumper center bar, remove six nuts securing impact strip to bumper and remove impact strip.

b. Installation

1. Position impact strip on bumper, engaging six studs in mounting holes. Check alignment of strip to bumper, as some side-to-side adjustment is possible.
2. Install six nuts on studs using access holes on rear face and underside of bumper. Tighten to 50 inch-pounds.

10. Front Bumper Outer Impact Strip—On Car (Fig. 14-7)

a. Removal

1. Of seven nuts securing impact strip, remove the four securing strip to bumper outer end. Access to nut at corner of bumper can be gained by using a U-joint socket and extension.

(NOTE: Eldorado impact strip is secured to outer end at three locations only.)

2. Remove two nuts securing strip to bumper center bar using access holes behind bumper bar.
3. Removal of center most attaching nut will have to be chisled off.

(NOTE: When replacing impact strip a repair retainer is available.)

b. Installation

1. Position impact strip on bumper, engaging each of seven studs (six on Eldorado) in mounting holes in bumper. Check alignment of strip to bumper.
2. Install two nuts securing impact strip to bumper center bar using access holes behind bumper. Tighten to 50 in. lbs.
3. Install nuts securing impact strip to bumper outer end. Access to nut at corner of bumper can be gained by using a U-joint socket and extension. Tighten to 50 in. lbs.
4. Install retainer at center most attaching.

11. Front Lower Outer End—Except Eldorado (Fig. 14-7)

a. Removal

1. Remove one bolt and tapping plate securing wheelhousing splash shield to lower outer end of bumper.
2. Remove two bolts and nuts securing lower outer end to upper outer end.
3. Remove one nut securing support rod to lower outer bumper bar tab.
4. Remove one bolt, spacer, and nut securing lower outer end to rear of bumper guard.
5. Remove two bolts and washers securing lower outer end to bumper center bar.

b. Installation

1. Make sure U-nuts are in place on center bar, then position lower outer end against center bar and install two bolts and washers securing lower outer end to center bar.
2. Install one bolt, spacer, nut and washer assembly securing lower outer end to rear of bumper guard.
3. Install two bolts, nuts, and washers securing lower outer end to upper outer end.
4. Install support rod in lower outer bumper bar tab and secure with one nut and washer assembly.
5. Position wheelhousing splash shield on tab on bumper and fasten with one bolt and tapping plate.

12. Front Upper Outer End—Except Eldorado (Fig. 14-7)

a. Removal

1. Remove lower outer end as described in Note 11a.
2. Remove four nuts securing impact strip to upper outer end and remove strip from upper outer end.
3. Remove two screw and washer assemblies securing upper outer end and shims (and bumper support bracket on 6F and 6Z) to bumper center bar.

(NOTE: Take care to note number and position of shims for proper installation.)

4. Remove two screw and washer assemblies and tapping plate securing upper outer end to upper center bar.

b. Installation

1. Align outer end, center bar, (and support bracket, if so equipped) insert two bolt and washer assemblies from front side, and thread tapping plate a few turns.
2. Insert shims between outer end and center bar.
3. Continue tightening two nuts to 30 foot-pounds.
4. Install two screws and tapping plate securing bumper center bar to outer end, tightening to 30 foot-pounds.
5. Insert impact strip studs in outer end, securing with four nuts. Tighten to 50 inch-pounds.
6. Install lower outer end as described in Note 11b.

13. Rear Bumper—Except Commercial

a. Removal

1. Scribe alignment marks on bumper at EA unit for proper orientation on assembly.
2. Support bumper at center with hydraulic jack.
3. Remove four nuts and washers securing EA unit to bumper and remove jacking support bracket.
4. Repeat Step 3 on other side of car.
5. Open deck lid and pull trim out to gain access to outer end attaching nut.
6. Remove nut and seal assembly securing each outer end to body.
7. Move bumper away from body. Disconnect body connectors and remove screws securing ground wires to frame.
8. Remove bumper and remove shims from EA unit mounting bolts, and remove washer and shims from each outer end mounting bolt.

b. Installation

1. Place washers and shims on outer end mounting bolts and EA unit mounting bolts as required.
2. Move bumper into position. Install screws securing ground wires to frame and connect body connectors.
3. Locate outer end and EA unit mounting bolts in their proper position and position outer end and deck lid fillers.
4. Loosely install both outer end washers and nuts. Do not tighten.
5. Position jacking support bracket on EA unit mounting bracket and install 4 nuts and washers on each side of car. Do not tighten.
6. Position bumper according to scribed lines at EA units making sure jacking support bracket is touching support on body, and tighten mounting nuts to 30 foot-pounds.
7. Tighten outer end mounting nuts to 12 foot-pounds and reposition trunk trim.
8. Close deck lid and move jack away from car.

14. Rear Bumper Center Impact Strip—All Cars (Fig. 14-8)

a. Removal

1. Working under bumper, remove two screws securing license plate filler and retainers.
2. Remove ten nuts securing impact strip to bumper.
3. Remove license plate filler and retainers.

b. Installation

1. Position impact strip on bumper so that part number stamping is left of center of bumper.
2. Install two license lamp assemblies on center studs of impact strip.
3. Secure impact strip with ten nuts and washer assemblies on studs of impact strip. Tighten to 50 inch-pounds.

CAUTION: Do not overtorque or strip as it could take on a distorted appearance.

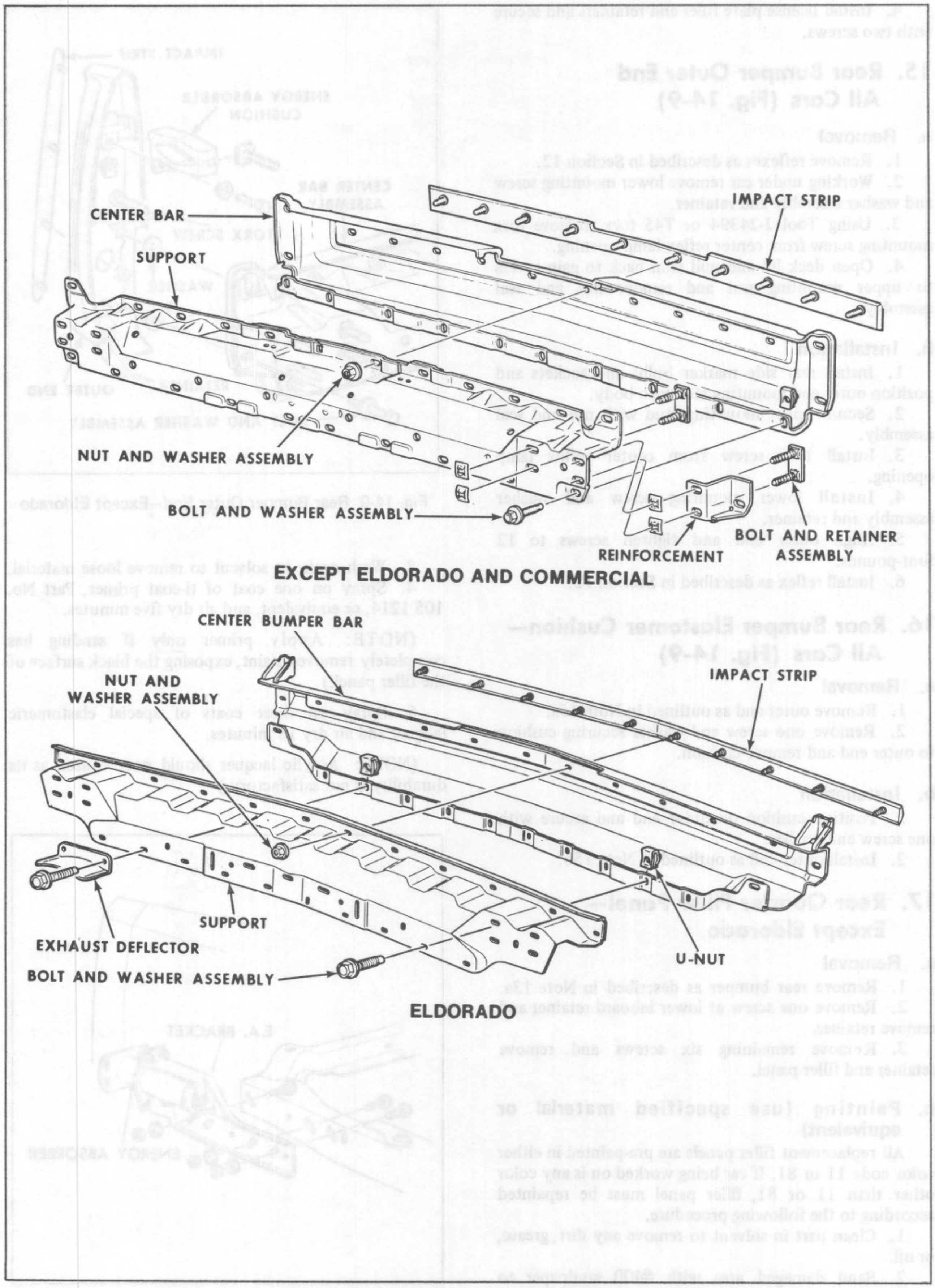


Fig. 14-8 Rear Bumper Center Bar Assembly

4. Install license plate filler and retainers and secure with two screws.

15. Rear Bumper Outer End All Cars (Fig. 14-9)

a. Removal

1. Remove reflexes as described in Section 12.
2. Working under car remove lower mounting screw and washer assembly and retainer.
3. Using Tool J-24394 or T45 torx, remove torx mounting screw from center reflex lamp opening.
4. Open deck lid and pull trim back to gain access to upper mounting nut and remove nut and seal assembly.

b. Installation

1. Install rear side marker bulbs and sockets and position outer end mounting stud into body.
2. Secure upper mounting stud with nut and seal assembly.
3. Install torx screw from center reflex lamp opening.
4. Install lower mounting screw and washer assembly and retainer.
5. Align outer end and tighten screws to 12 foot-pounds.
6. Install reflex as described in Section 12.

16. Rear Bumper Elastomer Cushion—All Cars (Fig. 14-9)

a. Removal

1. Remove outer end as outlined in Note 15a.
2. Remove one screw and washer securing cushion to outer end and remove cushion.

b. Installation

1. Position cushion on outer end and secure with one screw and washer.
2. Install outer end as outlined in Note 15b.

17. Rear Quarter Filler Panel—Except Eldorado

a. Removal

1. Remove rear bumper as described in Note 13a.
2. Remove one screw at lower inboard retainer and remove retainer.
3. Remove remaining six screws and remove retainer and filler panel.

b. Painting (use specified material or equivalent)

All replacement filler panels are pre-painted in either color code 11 or 81. If car being worked on is any color other than 11 or 81, filler panel must be repainted according to the following procedure.

1. Clean part in solvent to remove any dirt, grease, or oil.
2. Sand damaged area with #400 sandpaper to feather edge the damaged area. If repainting a replacement part, sand entire part to promote adhesion.

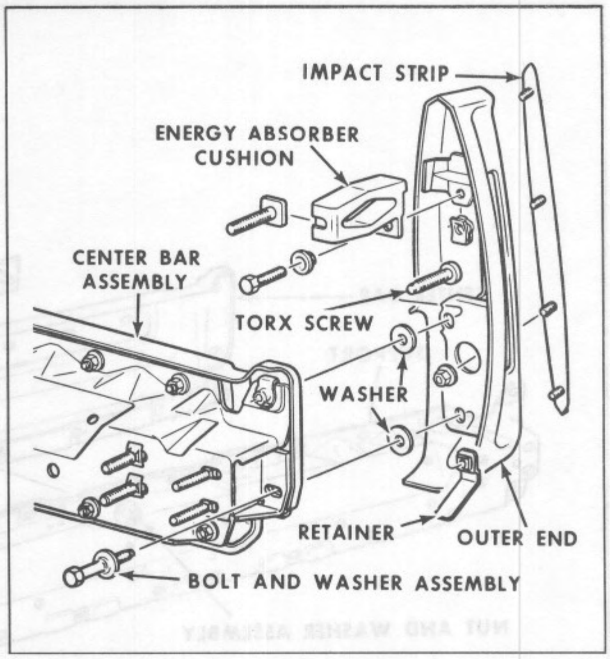


Fig. 14-9 Rear Bumper Outer End—Except Eldorado

3. Wash again in solvent to remove loose material.
4. Spray on one coat of ti-coat primer, Part No. 105 1214, or equivalent, and air dry five minutes.

(NOTE: Apply primer only if sanding has completely removed paint, exposing the black surface of the filler panel.)

5. Spray on three coats of special elastomeric lacquer and air dry 15 minutes.

(NOTE: Acrylic lacquer should not be used as its durability is not satisfactory.)

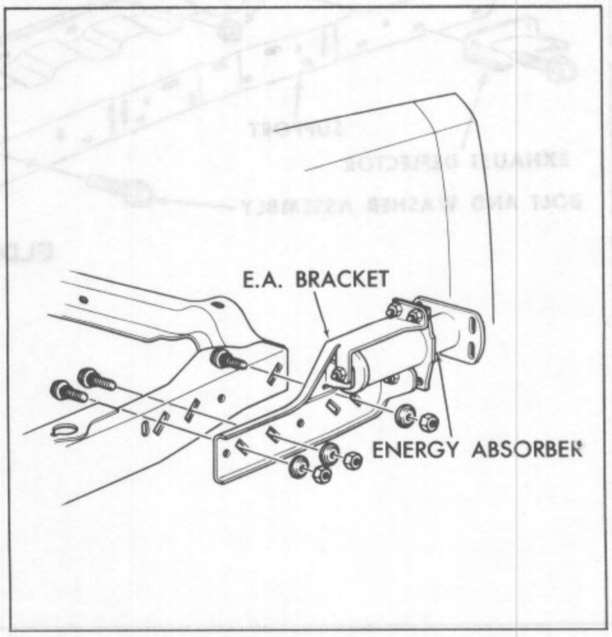


Fig. 14-10 Rear E.A. Unit and Mounting Bracket

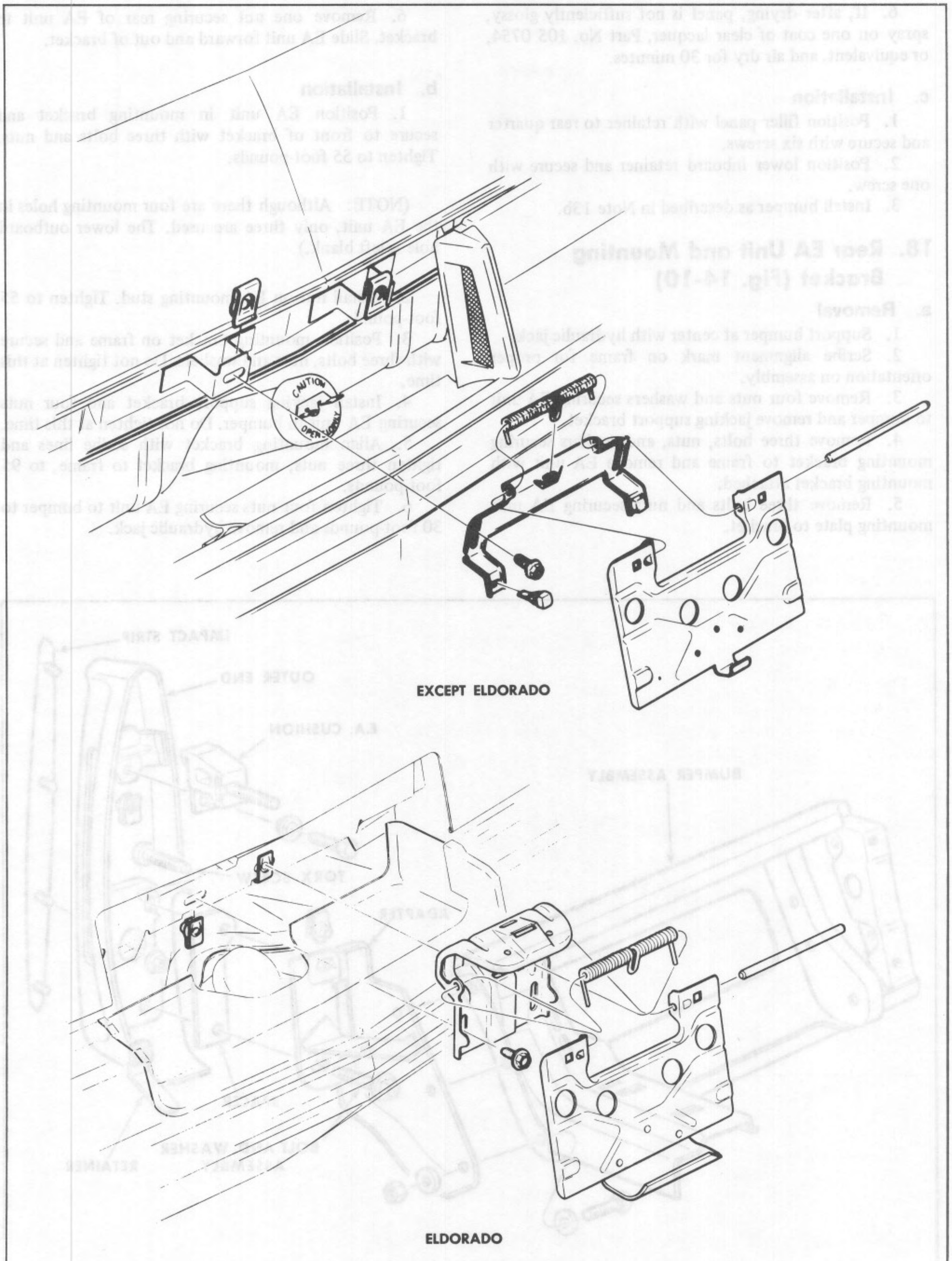


Fig. 14-11 Fuel Filler Door

6. If, after drying, panel is not sufficiently glossy, spray on one coat of clear lacquer, Part No. 105 0754, or equivalent, and air dry for 30 minutes.

c. Installation

1. Position filler panel with retainer to rear quarter and secure with six screws.
2. Position lower inboard retainer and secure with one screw.
3. Install bumper as described in Note 13b.

18. Rear EA Unit and Mounting Bracket (Fig. 14-10)

a. Removal

1. Support bumper at center with hydraulic jack.
2. Scribe alignment mark on frame for proper orientation on assembly.
3. Remove four nuts and washers securing EA unit to bumper and remove jacking support bracket.
4. Remove three bolts, nuts, and washers securing mounting bracket to frame and remove EA unit with mounting bracket attached.
5. Remove three bolts and nuts securing EA unit mounting plate to bracket.
6. Remove one nut securing rear of EA unit to bracket. Slide EA unit forward and out of bracket.

b. Installation

1. Position EA unit in mounting bracket and secure to front of bracket with three bolts and nuts. Tighten to 55 foot-pounds.

(NOTE: Although there are four mounting holes in the EA unit, only three are used. The lower outboard hole is left blank.)

2. Install nut on EA mounting stud. Tighten to 55 foot-pounds.
3. Position mounting bracket on frame and secure with three bolts, nuts and washers. Do not tighten at this time.
4. Install jacking support bracket and four nuts securing EA unit to bumper. Do not tighten at this time.
5. Align mounting bracket with scribe lines and tighten three nuts, mounting bracket to frame, to 95 foot-pounds.
6. Tighten four nuts securing EA unit to bumper to 30 foot-pounds and remove hydraulic jack.

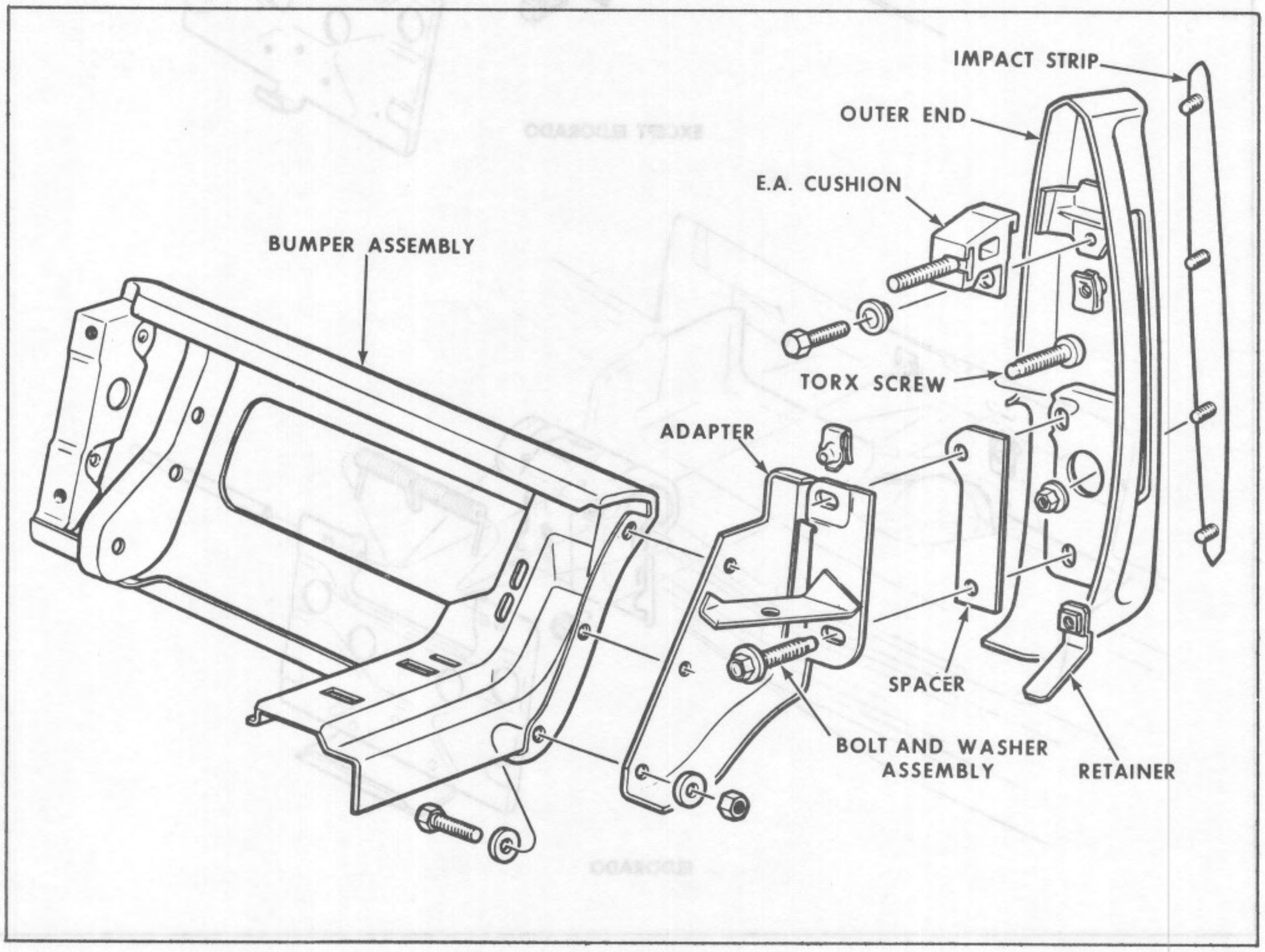


Fig. 14-12 Rear Bumper Disassembled—Commercial Chassis

19. Fuel Filler Door (Fig. 14-11)

a. Removal

Open door and remove two screws securing backing plate to body and remove assembly.

(NOTE: If working on Eldorado, also remove clip securing lamp wiring to backing plate. Then, disconnect wiring at body harness.)

b. Installation

Make sure U-nuts are properly placed, then position door assembly and secure with two screws. If car is an Eldorado, connect wiring at body harness and clip wire to backing plate.

ELDORADO BUMPERS

GENERAL DESCRIPTION

Eldorado front bumpers are of ten piece construction, Fig. 14-13. Attached to the upper center bar are two bumper guards, a lower center bar, a lower intermediate bar on each side, and one-piece outer ends. Attachment to frame, energy absorption provisions, grille mounting, and other features are similar to their counterparts on other styles. Refer to the forward portion of this section for further information.

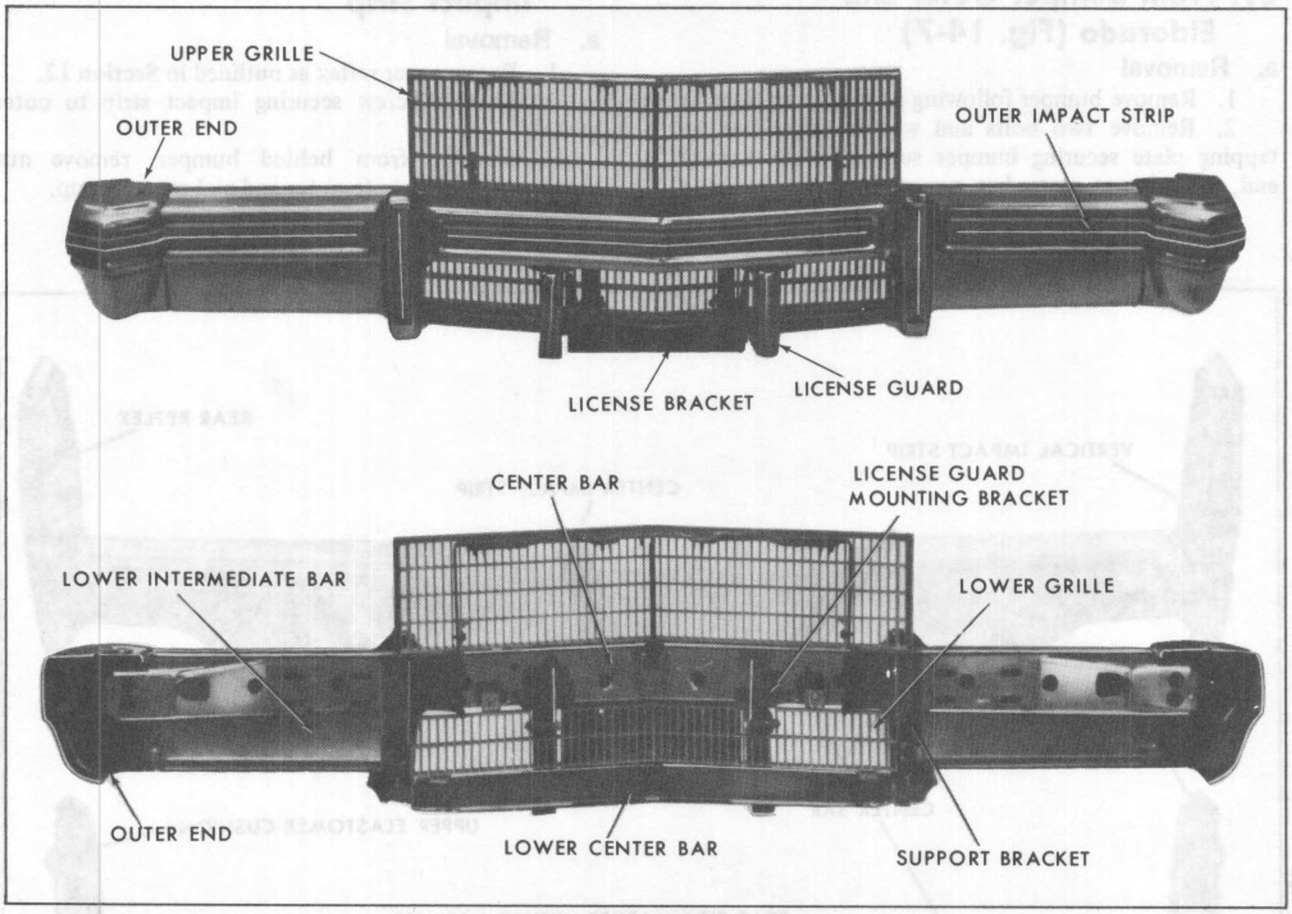


Fig. 14-13 Eldorado Front Bumper

SERVICE INFORMATION

The service information that follows pertains only to those features exclusive to the Eldorado. Service Information given in the forward portion of this section also pertains to the Eldorado, except for those note headings in which "Except 6L" or "Except Eldorado" is explicity stated.

20. Front Fender Filler Panel—Eldorado

a. Removal

1. Working under car, remove three screws and washers securing filler and reinforcement strip to forward end of fender.

2. Remove one screw and washer securing reinforcement strip to filler panel.

b. Painting

Follow procedure in Note 17b.

c. Installation

1. Position reinforcement strip on filler panel and insert four screws and washers.

2. Position assembly on front fender and tighten mounting screws to 25 inch-pounds.

21. Front Bumper Outer End—Eldorado (Fig. 14-7)

a. Removal

1. Remove bumper following procedure in Note 3a.

2. Remove two bolts and washer assemblies and tapping plate securing bumper support bracket, outer end, and shims to center bar.

3. Remove two bolt and washer assemblies and tapping plate securing outer end to center bar.

4. Remove one bolt and nut securing outer end to lower intermediate bar and remove outer end.

b. Installation

1. Position outer end and secure to lower intermediate bar with one bolt and nut.

2. Position support bracket and insert two bolt and washer assemblies through bracket, outer end and center bar. Start bolts into tapping plate.

3. Install shims and tighten bolts and nuts to 30 foot-pounds.

4. Install two bolt and washer assemblies and tapping plates securing outer end to center bar. Tighten to 30 foot-pounds.

5. Install bumper as in Note 3b.

22. Rear Bumper Vertical Impact Strip

a. Removal

1. Remove rear reflex as outlined in Section 12.

2. Remove screw securing impact strip to outer end.

3. Working from behind bumper, remove nut securing impact strip to outer end and remove strip.

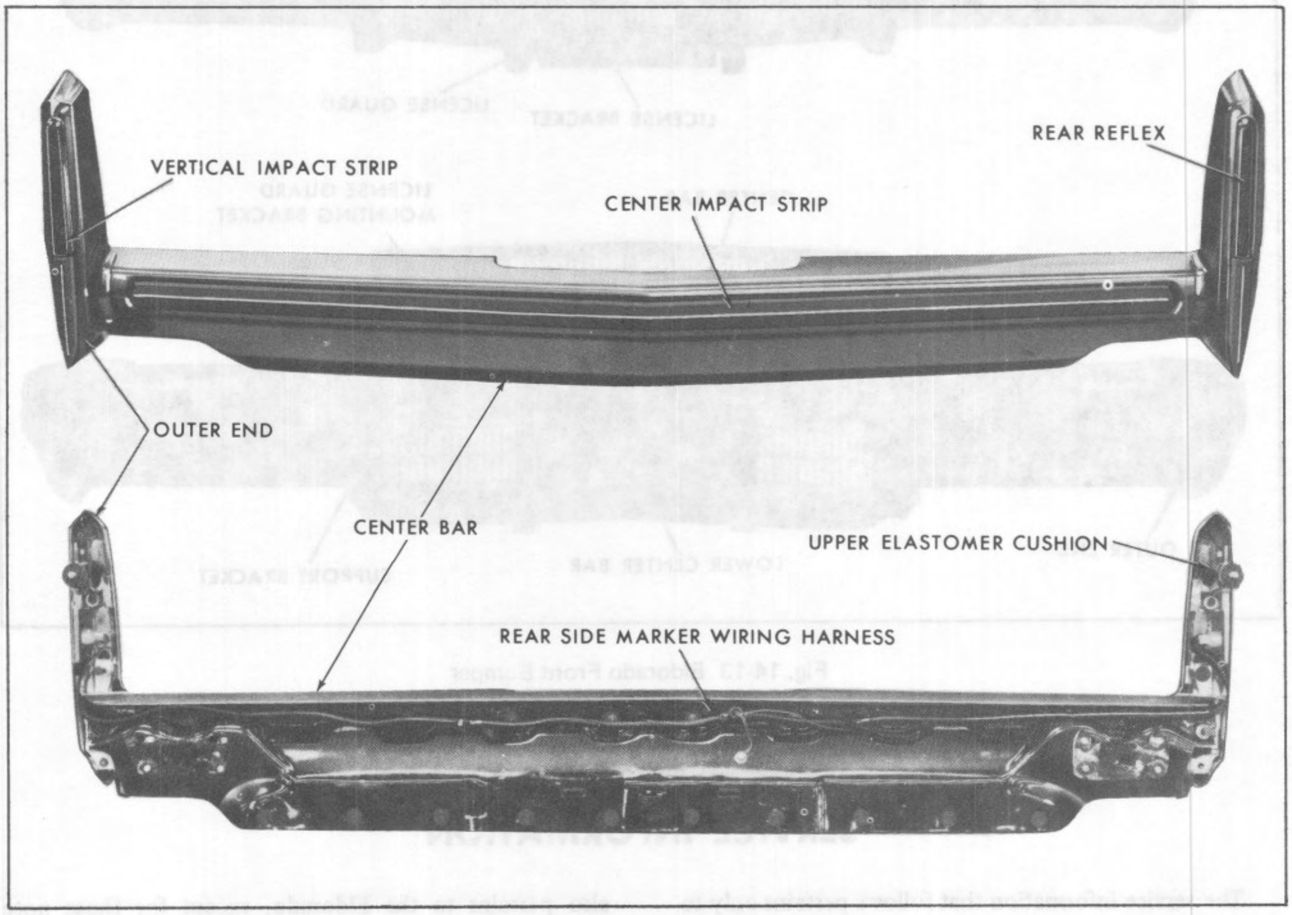


Fig. 14-14 Eldorado Rear Bumper

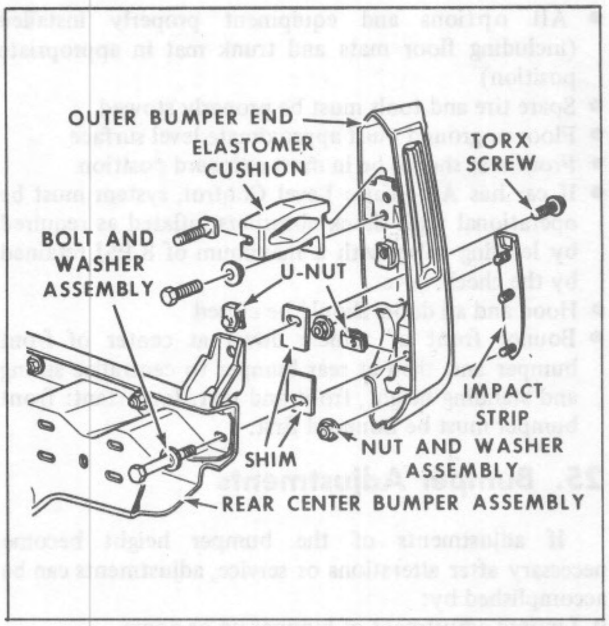


Fig. 14-15 Eldorado Rear Bumper Outer End

b. Installation

1. Postion impact strip on outer end and secure with screw in reflex opening.
2. Working from behind bumper, install one nut securing impact strip to outer end.
3. Install reflex as outlined in Section 12.

23. Rear Quarter Filler Panel—Eldorado

a. Removal

1. Open trunk and pull trim away from outer end area.
2. Working from inside trunk, remove four nuts securing filler panel to body.
3. Pull filler panel away from outboard side of outer end and remove two screws securing filler panel to body.
4. Remove outer most screw on trunk lid filler and pull outer end filler panel up and away from body.

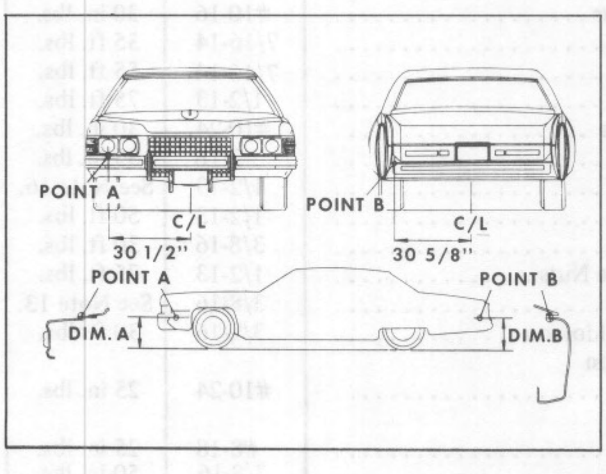


Fig. 14-16 Bumper Height Locating Points—C-Car

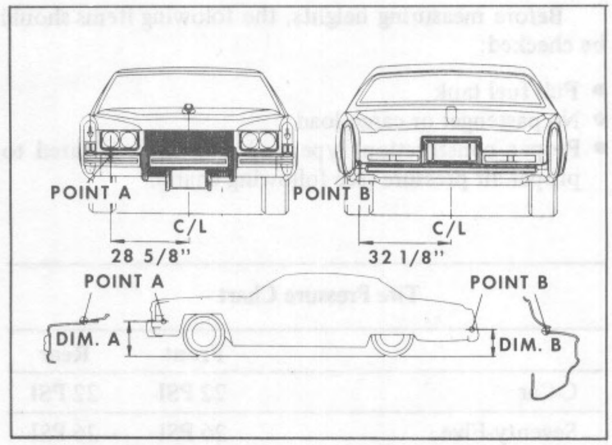


Fig. 14-17 Bumper Height Locating Points—Eldorado

b. Installation

1. Position filler panel around outer end and under trunk lid filler panel.
2. Install outer most screw on trunk lid filler panel.
3. Pull filler panel away from outboard side of outer end and install two screws securing panel to body.
4. Working from inside trunk, install four nuts securing filler panel to body.
5. Reposition trunk trim and close trunk lid.

24. Bumper Height Specifications (Fig. 14-16 and 14-17)

The maximum and minimum specifications for bumper-to-ground heights are shown in the following chart:

Bumpers	Maximum	Minimum
Dim. A Front—All Cars	24 1/4″	20 3/16″
Dim. B Rear—C-Cars	24 3/8″	21 1/16″
Eldorados	22 15/16″	19 15/16″

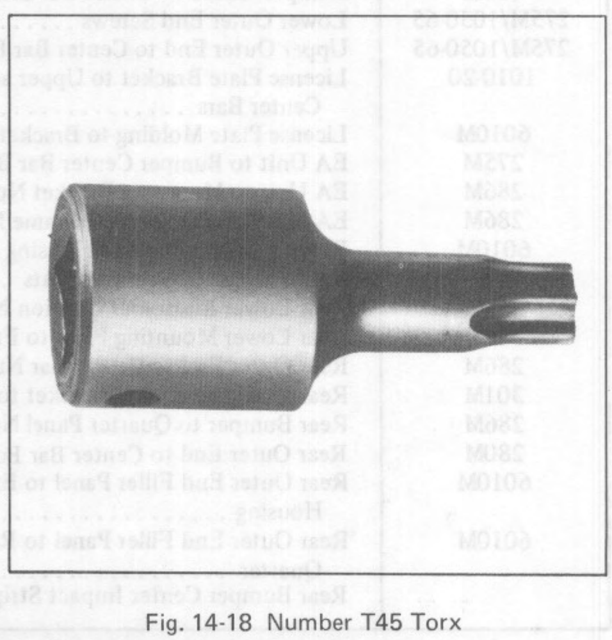


Fig. 14-18 Number T45 Torx

Before measuring heights, the folowing items should be checked:

- Full fuel tank
- No passenger or cargo load
- Proper construction type and size tires, inflated to proper air pressure (see following chart).

Tire Pressure Chart

	Front	Rear
C-Car	22 PSI	22 PSI
Seventy-Five	26 PSI	26 PSI
Eldorado	25 PSI	20 PSI

(NOTE: These pressures are used for measurement only. Inflate tires to pressure shown on tire placard inside glove compartment after measurements.)

Tire pressure tolerance is ±2 PSI and tires are to be checked at room temperature.

- All options and equipment properly installed (including floor mats and trunk mat in appropriate position)
- Spare tire and tools must be properly stowed
- Floor or ground must approximate level surface
- Front seat should be in most rearward position
- If car has Automatic Level Control, system must be operational with shock absorbers inflated as required by leveling valve with a maximum of 8 PSI retained by the check valve
- Hood and all doors should be closed
- Bounce front of vehicle down at center of front bumper and then at rear bumper to centralize spring and standing height, front and rear. Important: front bumper must be Bounced first.

25. Bumper Adjustments

If adjustments of the bumper height become necessary after alterations or service, adjustments can be accomplished by:

- Limited adjustment of bumper up or down
- Adjustment of torsion bars on Eldorado
- Trimming of ALC rear control valve, if so equipped
- Replacement of coil springs

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
284M	Impact Strip Nuts (Except Bumper Guards)	1/4-20	50 in. lbs.
284M	Bumper Guard Impact Strip Nuts	#10-24	5 in. lbs.
275M/1050-65	Lower Center Support Rod Screws	5/16-18	18 ft. lbs.
280M	Bumper Guard to Center Bar Screws	3/8-16	30 ft. lbs.
275M/1050-65	Lower Outer End Screws	5/16-18	18 ft. lbs.
275M/1050-65	Upper Outer End to Center Bar Bolts	3/8-16	30 ft. lbs.
1010-20	License Plate Bracket to Upper and Lower Center Bars	1/4-20	50 in. lbs.
6010M	License Plate Molding to Bracket Screws	#10-16	30 in. lbs.
275M	EA Unit to Bumper Center Bar Bolts	7/16-14	35 ft. lbs.
286M	EA Unit to Mounting Bracket Nuts	7/16-14	55 ft. lbs.
286M	EA Mounting Bracket to Frame Nuts	1/2-13	75 ft. lbs.
6010M	Rear License Lamp and Housing Screws	#10-24	30 in. lbs.
1050	Back Up Lamp Mounting Nuts	3/16	35 in. lbs.
286M	Rear Lower Elastomer Cushion Nut	1/2-13	See Note 16.
286M	Rear Lower Mounting Plate to Frame	1/2-13	50 ft. lbs.
286M	Rear Outer End to Center Bar Nuts	3/8-16	30 ft. lbs.
301M	Rear Lower Mounting Bracket to Frame Nuts	1/2-13	75 ft. lbs.
286M	Rear Bumper to Quarter Panel Nut	3/8-16	See Note 13.
280M	Rear Outer End to Center Bar Bolts - Eldorado	3/8-16	30 ft. lbs.
6010M	Rear Outer End Filler Panel to Extension Housing	#10-24	25 in. lbs.
6010M	Rear Outer End Filler Panel to Rear Quarter	#8-18	25 in. lbs.
	Rear Bumper Center Impact Strips	3/8-16	50 in. lbs.

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RADIO AND ANTENNA
THEORY OF OPERATION

The radio options include an AM/FM pushbutton radio, Fig. 15-1; an AM/FM pushbutton stereo signal seeking radio, Fig. 15-2; an AM/FM pushbutton stereo radio with an integral eight-track tape player, Fig. 15-3, and for Fleetwood Seventy-Five styles, an AM/FM pushbutton stereo radio with signal seeking and rear remote radio controls. Radios are provided as standard equipment on later 1974 model cars. The radio receiver unit is located in the instrument panel to the right of the steering column. The AM/FM pushbutton radio consists of a receiver unit and three separate speaker units. The stereo radios consist of a receiver unit and four separate speaker units.

There are two 3-1/2 inch round front speakers, one at each end of the upper instrument panel cover, on all radio installations. Two 6 inch x 9 inch rear speakers, one at each end of the rear filler panel, are used on all stereo installations except convertibles. On convertibles, the rear stereo speakers are mounted behind the rear seat in the well for the convertible top. On convertibles with an AM/FM radio, only the right rear speaker is installed.

On stereo installations, the left front and right rear speakers are on one channel and the right front and left rear speakers are on another channel.

All receivers are equipped with a frequency band selector bar. Moving the band selector bar to the left, engages the FM band and all preset FM stations. Conversely, moving the selector bar to the right engages the AM band. Any preset station is mechanically tuned in by depressing the appropriate pushbutton located directly below the band selector bar.

An electrically operated, telescoping rod-type antenna, Fig. 15-4, is installed with all radios. This antenna is designed for improved AM/FM fringe area, and FM metropolitan area performance. It is mounted in the right front fender assembly.

There are two controls for the antenna; an automatic control and a manual control. The automatic antenna control is integral with the radio on-off control. The antenna raises to a pre-set height of approximately twelve inches when the radio is turned on and fully retracts when the radio or ignition switch is turned off. A manually operated antenna up-down control switch, Fig. 15-5 is located in the accessory switch panel to the right of the steering column. It is used to raise the antenna higher than the pre-set height for fringe area reception, or to lower the antenna when necessary to clear low overhead objects.

Also, placing the manual switch in the full up position before turning the radio on will allow the antenna to by pass the twelve inch limit and go to the full up position when the radio is turned on. Turning off the radio or ignition switch fully retracts the antenna even though the manual switch is left in the up detent position.

The antenna is operated by a reversible electric motor. The motor drives a gear and pulley assembly that extends or retracts a drive cable fastened to the smallest of the three antenna sections. The action of the drive cable, as it is extended, forces the antenna rod upward.

In lowering the antenna, the drive cable is retracted. This pulls the three sections of the antenna rod downward.

CAUTION: Do not raise or lower the antenna by hand. This may damage the operating mechanism.

AM/FM and AM/FM Stereo Radio

The AM/FM and AM/FM Stereo radios have advantages and limitations that must be explained to owners who are not familiar with the operations of FM units.

The frequencies (88-108MHZ) at which FM stations operate create much shorter radio wave lengths than those produced in AM broadcasting. Unlike AM signals, FM signals do not bend around the horizon. This limits the distance at which FM signals can be received. The dependable range of FM reception in an automobile is a radius of approximately thirty miles from the transmitting antenna.

When the FM receiver moves out of range of the FM transmitter, it enters what is referred to as the fringe area. In the fringe area, the strength of the FM signal may vary rapidly, causing a flutter or a series of noise bursts as the car moves between high and low level signal points.

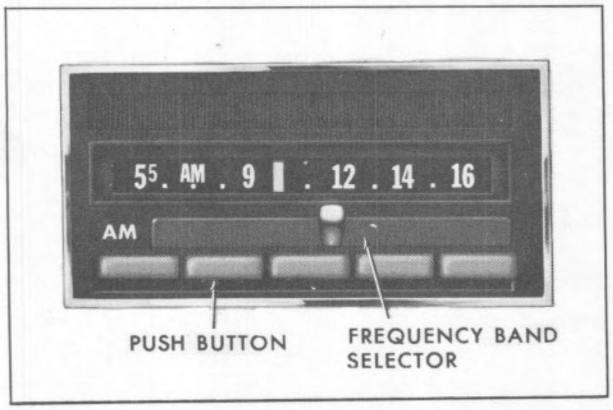


Fig. 15-1 AM/FM Pushbutton Receiver

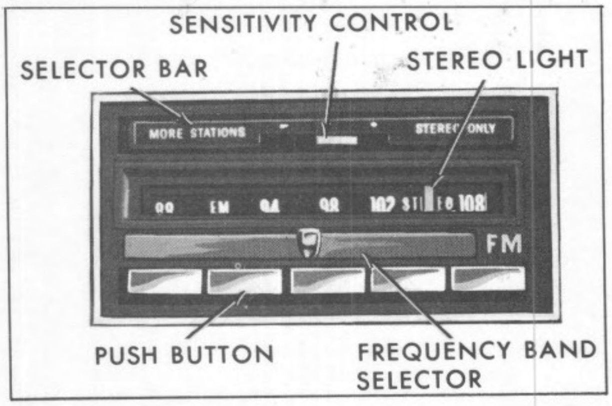


Fig. 15-2 AM/FM Signal Seeking Stereo

Fig. 15-3 AM/FM Stereo Eight Track Tape

A second effect found in the fringe area is the presence of ignition interference from adjacent vehicles. In both instances, it may be possible to improve reception by careful retuning; however, it may be necessary to change to a different station if reception still is not good.

Retuning should be necessary only in those few instances when reception becomes slightly noisy while driving through areas such as the center of a large city and a weak signal is being received from a station located away from the center of the city. The interference can be reduced by adjusting the tone control for more bass, and by shifting the speaker fader to favor the rear seat. While these adjustments will slightly diminish stereo effect on cars so equipped, they will substantially reduce background noise interference.

As soon as reception clears, reset the tone control to the normal detent and again adjust the front and rear speakers for equal output.

The FM section of the AM/FM and AM/FM Stereo radios is equipped with automatic frequency control, which aids tuning to a station. The FM receiver should be tuned directly on station frequency for minimum noise interference; however, the automatic frequency control will tune directly to and lock on station frequency when slight mistuning is encountered.

Another feature of FM tuning is signal separation. When two FM stations are close in frequency, the FM tuner selects the stronger signal, rejecting the weaker one. This is in contrast to AM performance, where it is not always possible to separate two stations.

The AM/FM radio incorporates an AM receiving circuit and an FM receiving circuit. The audio system is common to both receiving circuits.

The AM/FM Stereo radio incorporates an AM receiving circuit, an FM receiving circuit, an FM stereo detection circuit, and a dual channel audio amplifier in one unit.

The signal seeking feature is provided on the AM/FM Stereo radio. The AM and FM frequency band selector bar is located below the receiver dial.

AM/FM Stereo radios should always be fine tuned to assure maximum signal response and minimize unwanted noise.

To simplify tuning, only the dial for the frequency band selected is visible. The letters "AM" or "FM" on either side of the selector bar show the frequency band selected.

On stereo radios, the letters "STEREO" on the right side of the dial illuminate as shown in Fig. 15-2 when the FM station tuned is capable of transmitting stereo. The illumination of the letters "STEREO", however, does not indicate that the station is transmitting stereo at the particular moment. Stereo programs are broadcast on the FM frequency band only.

AM/FM Stereo Radio and Eight Track Tape Player

With the AM/FM stereo radio and eight-track tape player, the owner may make his own selection of prerecorded music. To operate in the tape player mode, turn the radio on and fully insert a tape cartridge into the opening behind the face of the receiver dial. The dial face will swing up into the receiver, similar to a mail chute door, when the tape cartridge is inserted. This automatically removes power from the radio and switches control of the speakers to the tape player.

To change tape programs, momentarily depress the volume control knob. Each time the volume control knob is depressed, the tape cartridge will change to the next recorded program. To eject the tape cartridge from the engaged position, gently pull out on the volume control knob. The cartridge may be left in this ejected position without damage to the tape. With the tape cartridge ejected, power is automatically returned to the radio along with control of the speakers. To fully remove the tape cartridge, pull gently out of the radio face.

Tape cartridges should be handled carefully and should be kept clean. A cartridge should not be left inserted fully in the player. This may cause permanent damage to the cartridge.

Signal Seeking Tuner

The signal seeking tuner provided on AM/FM Stereo radios is electronically controlled so that the operator may change stations by depressing the selector bar. The signal seeking operation consists of a low to high frequency sweep (left to right) of the AM or FM broadcast band by the tuner.

When the selector bar is depressed and released, the tuner moves to the station of next higher frequency (to the right) and stops automatically at the point where that station is best received. This action takes place each time the selector bar is depressed. When the tuner has reached the point of highest frequency of the broadcast band, it returns to the low frequency (left) side of the broadcast band and begins a new sweep to the right, stopping at the first receivable station. The above procedure is then repeated when the bar is again depressed.

The stopping sensitivity of the signal seeking tuner may be varied by changing the position of the three-position sensitivity control switch located just below the center of the selector bar, Fig. 15-2. The third (right hand) position allows the signal seeking tuner to stop only on FM stereo stations when the radio is being played on the FM frequency band.

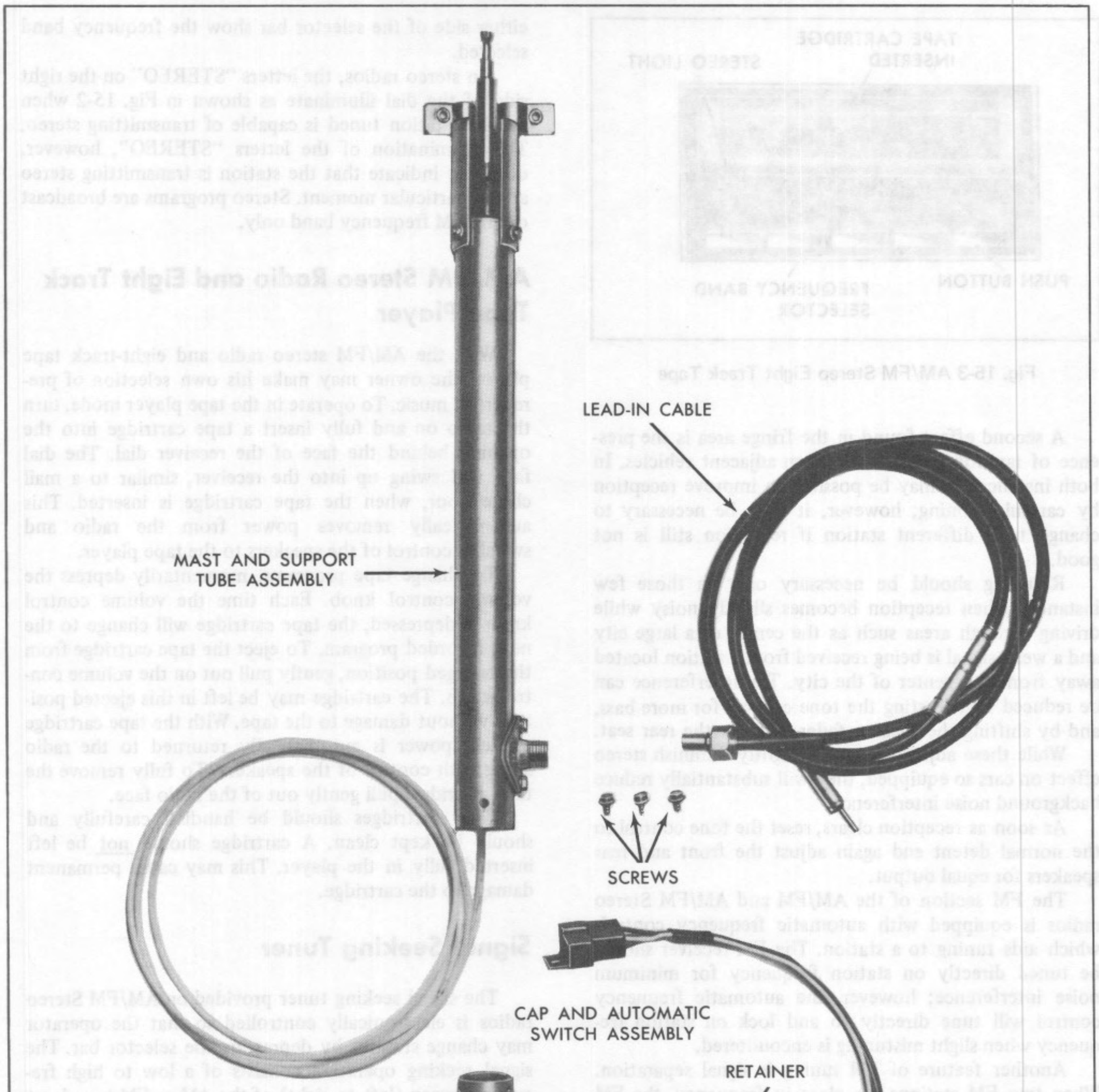


Fig. 15-4 Electric Antenna Disassembled

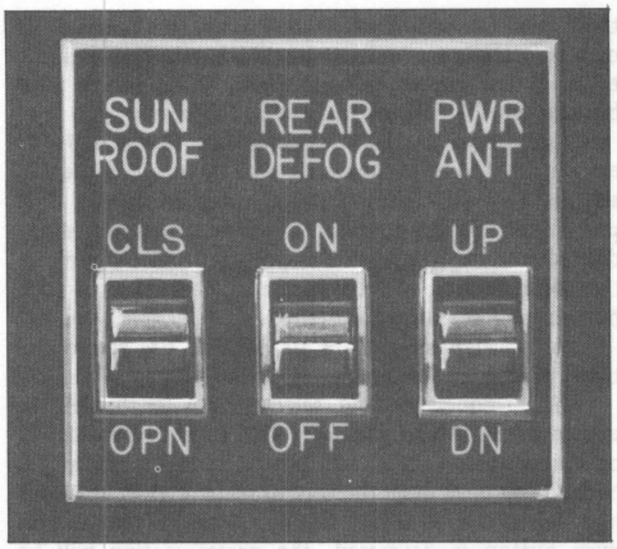


Fig. 15-5 Accessory Switch Panel

A foot control switch that performs the same station seeking functions as the station selector bar is available as a dealer installation for signal seeking radios only.

The circuit diagram for radios is illustrated in Fig. 15-6.

1. Radio Controls, Operation

a. Frequency Band Selector Bar

The frequency band selector bar is located below the frequency dial. Sliding the bar to the right engages the AM band, changes the dial to the AM frequency, and illuminates the "AM" tell-tale light located at the left side of the dial. Sliding the selector bar to the left engages the FM band, changes the dial to the "FM" frequency, and illuminates the "FM" tell-tale light located at the left side of the dial. Stereo broadcasts can be received on the FM band only. When an FM stereo

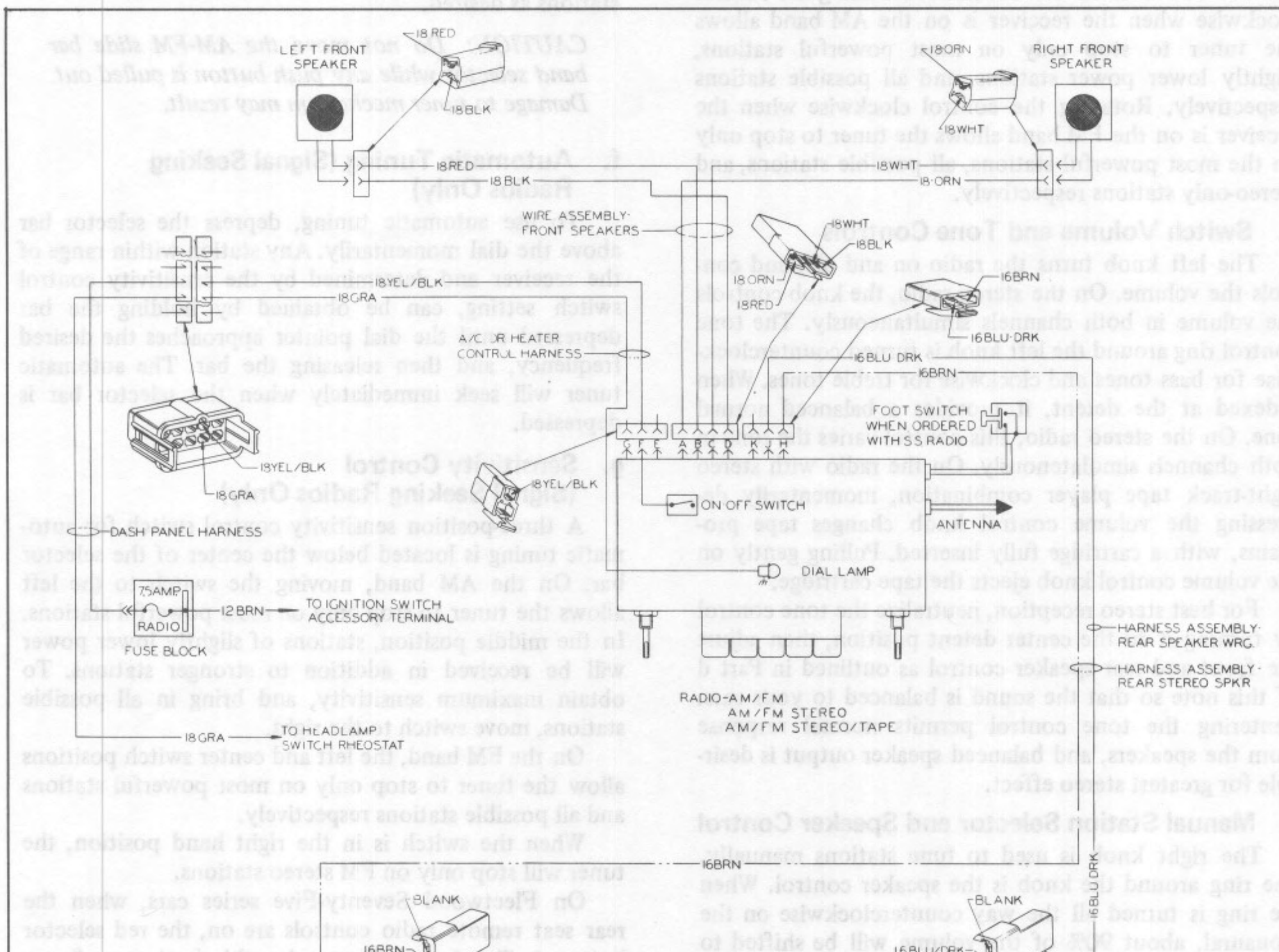


Fig. 15-6 Radio Circuit Diagram

station is tuned, the "Stereo" tell-tale light to the right of the dial illuminates.

On the stereo radio with the tape player, the "Stereo" light is located to the right of the band selector.

b. Rear Seat Remote Control (Fleetwood Seventy-Five Styles Only)

Rear seat remote radio control is available as an option for installation in Fleetwood Seventy-Five style cars equipped with the AM/FM stereo signal seeking radio. The remote controls consist of an ON-OFF volume control, a sensitivity control, and a selector button located behind the sliding access door in the right rear quarter panel trim.

Once the appropriate AM or FM band is selected at the radio, the rear seat remote control overrides the front radio control when it is turned on and off, and controls the volume in both channels simultaneously. The three position sensitivity control is located beneath the ON-OFF volume control knob. Rotating the control clockwise when the receiver is on the AM band allows the tuner to stop only on most powerful stations, slightly lower power stations, and all possible stations respectively. Rotating the control clockwise when the receiver is on the FM band allows the tuner to stop only on the most powerful stations, all possible stations, and stereo-only stations respectively.

c. Switch Volume and Tone Controls

The left knob turns the radio on and off, and controls the volume. On the stereo radio, the knob controls the volume in both channels simultaneously. The tone control ring around the left knob is turned counterclockwise for bass tones and clockwise for treble tones. When indexed at the detent, it provides a balanced normal tone. On the stereo radio, this control varies the tone in both channels simulatenously. On the radio with stereo eight-track tape player combination, momentarily depressing the volume control knob changes tape programs, with a cartridge fully inserted. Pulling gently on the volume control knob ejects the tape cartridge.

For best stereo reception, neutralize the tone control by turning it to the center detent position, then adjust the front and rear speaker control as outlined in Part d of this note so that the sound is balanced to your ears. Centering the tone control permits normal response from the speakers, and balanced speaker output is desirable for greatest stereo effect.

d. Manual Station Selector and Speaker Control

The right knob is used to tune stations manually. The ring around the knob is the speaker control. When the ring is turned all the way counterclockwise on the monaural, about 90% of the volume will be shifted to the front speakers. Turning the ring progressively clockwise will shift the speaker favor to the rear. Turning the ring to the full clockwise position shifts about 90% of the speaker volume to the rear speaker or speakers. This control has no effect on the balance of stereo channels.

e. Push Button Tuning (AM/FM or AM/FM Stereo Radios)

Each one of the five push buttons may be preset to a favorite AM station when on the AM band. Each one of these same five push buttons may be set to a favorite FM or stereo station when on the FM band. This makes a total of ten pre-set favorite stations. To preset push buttons on AM stations, proceed as follows:

Slide frequency band selector bar to the right to engage the AM band. Manually fine tune to favorite AM station. Pull push button straight out to unlatch then push in all the way to relatch. Push button is now set to desired station. Whenever this push button is depressed, the preset station will be selected. Set additional push buttons to AM stations as desired.

To preset push buttons to FM and FM stereo stations, proceed as follows:

Slide frequency band selector bar to the left to engage the FM band. Manually fine tune to favorite FM or stereo station. Pull push button straight out to unlatch. Then push in all the way to relatch. Push button is now set to desired FM or Stereo station. Whenever this push button is depressed, the preset station will be selected. Set additional push buttons to FM or stereo stations as desired.

CAUTION: Do not move the AM-FM slide bar band selector while any push button is pulled out. Damage to tuner mechanism may result.

f. Automatic Tuning (Signal Seeking Radios Only)

To use automatic tuning, depress the selector bar above the dial momentarily. Any station within range of the receiver and determined by the sensitivity control switch setting, can be obtained by holding the bar depressed until the dial pointer approaches the desired frequency, and then releasing the bar. The automatic tuner will seek immediately when the selector bar is depressed.

g. Sensitivity Control (Signal Seeking Radios Only)

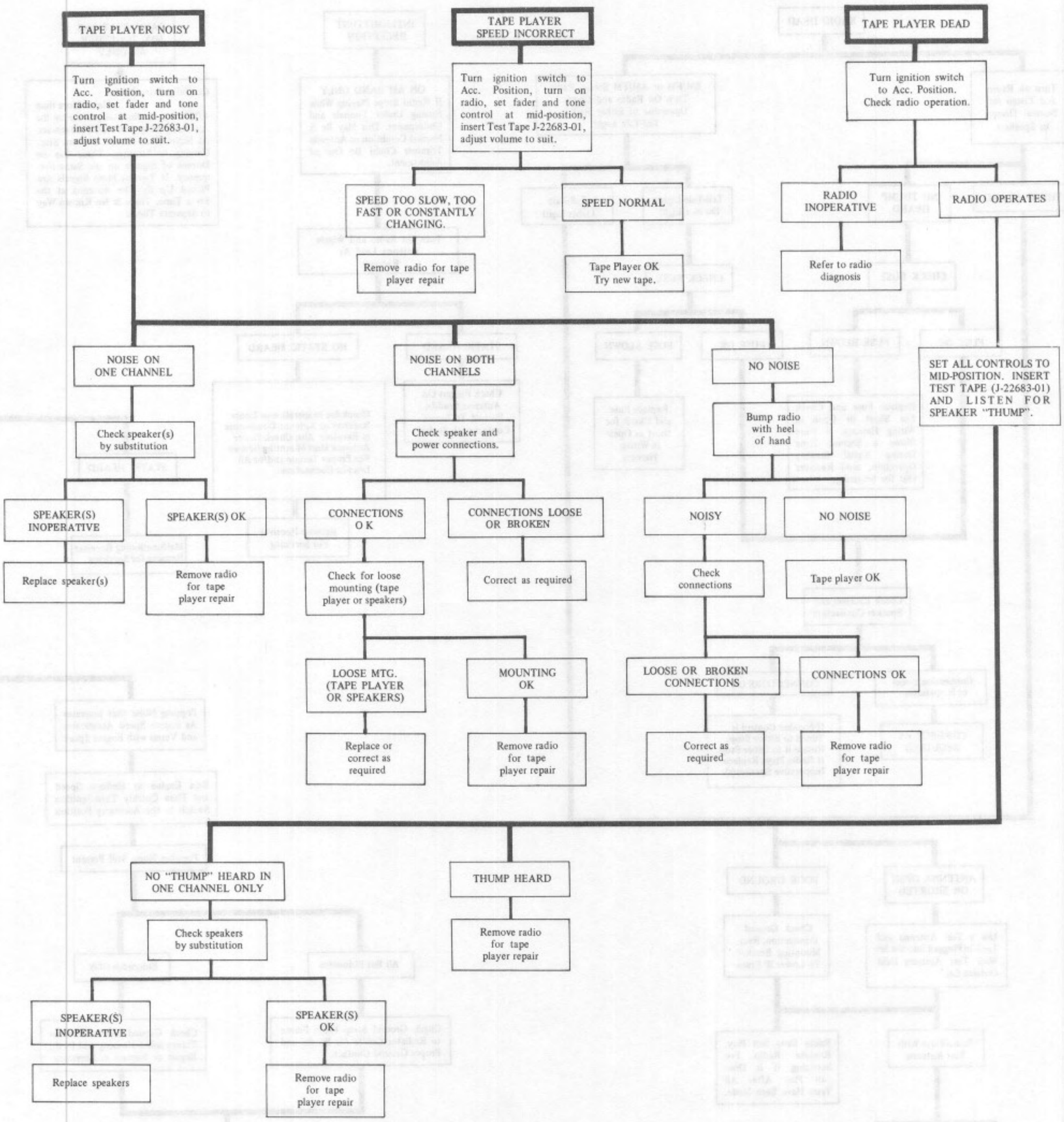
A three-position sensitivity control switch for automatic tuning is located below the center of the selector bar. On the AM band, moving the switch to the left allows the tuner to stop only on most powerful stations. In the middle position, stations of slightly lower power will be received in addition to stronger stations. To obtain maximum sensitivity, and bring in all possible stations, move switch to the right.

On the FM band, the left and center switch positions allow the tuner to stop only on most powerful stations and all possible stations respectively.

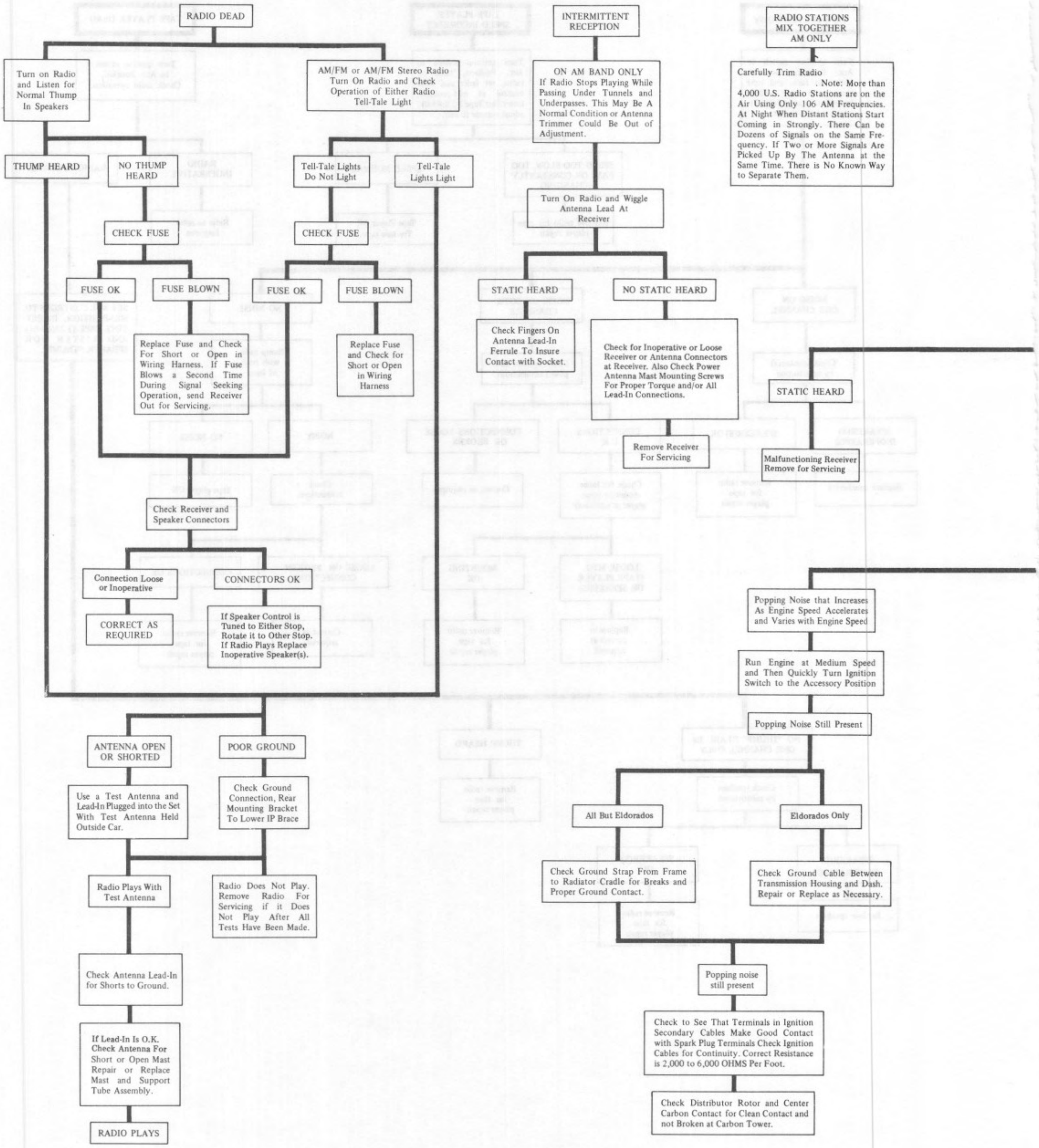
When the switch is in the right hand position, the tuner will stop only on FM stereo stations.

On Fleetwood Seventy-Five series cars, when the rear seat remote radio controls are on, the red selector button is illuminated. Depressing this button performs the same function as pressing the selector bar. With the rear seat radio control ON, the driver may reduce or increase the volume of the front speakers with the ring behind the right control knob, tune the radio manually or with the push buttons, and change the frequency bands. With the ring around the left control knob, he may vary the tone in both channels simultaneously. With remote control turned OFF, all front controls will operate normally.

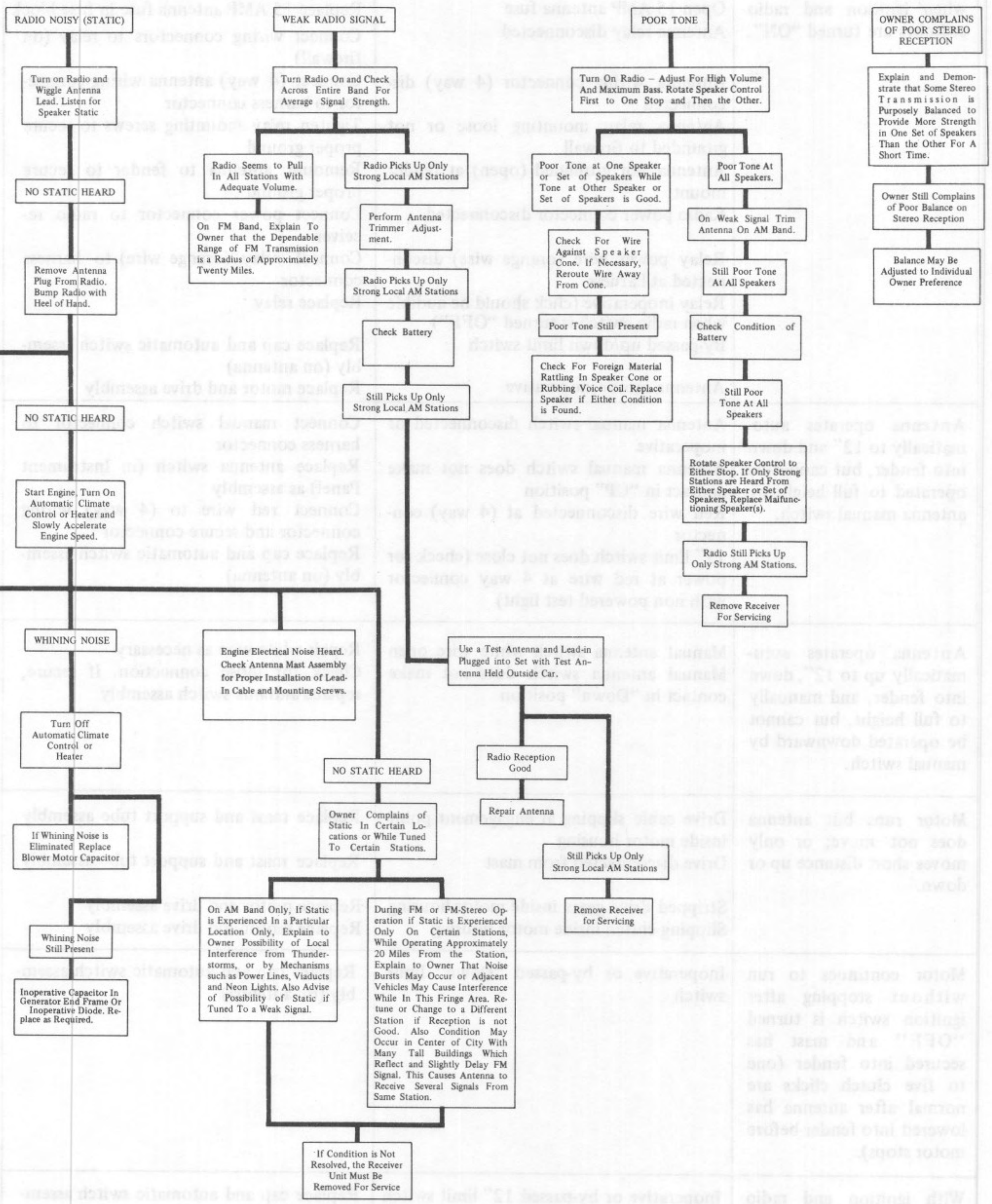
INTEGRAL STEREO EIGHT TRACK TAPE PLAYER DIAGNOSIS



RADIO DIAGNOSIS CHART



RADIO DIAGNOSIS CHART



ELECTRIC ANTENNA DIAGNOSIS

Condition	Cause	Correction
Antenna does not operate when ignition and radio switches are turned "ON".	Open 7 1/2 AMP radio fuse Open 15 AMP antenna fuse Antenna relay disconnected Antenna wiring connector (4 way) disconnected Antenna relay mounting loose or not grounded to firewall Antenna not grounded (open) at fender mount Radio power connector disconnected Relay power wire (orange wire) disconnected at harness Relay inoperative (click should be audible when radio switch is turned "OFF") By-passed up/down limit switch Antenna motor inoperative	Replace 7 1/2 AMP radio fuse in fuse block Replace 15 AMP antenna fuse in fuse block Connect wiring connectors to relay (on firewall) Connect (4 way) antenna wiring connector to harness connector Tighten relay mounting screws to secure proper ground Remount antenna to fender to secure proper ground Connect power connector to radio receiver Connect relay (orange wire) to harness connector Replace relay Replace cap and automatic switch assembly (on antenna) Replace motor and drive assembly
Antenna operates automatically to 12" and down into fender, but cannot be operated to full height by antenna manual switch.	Antenna manual switch disconnected or inoperative Antenna manual switch does not make contact in "UP" position Red wire disconnected at (4 way) connector 12" limit switch does not close (check for power at red wire at 4 way connector with non powered test light)	Connect manual switch connector to harness connector Replace antenna switch (in Instrument Panel) as assembly Connect red wire to (4 way) wiring connector and secure connector Replace cap and automatic switch assembly (on antenna)
Antenna operates automatically up to 12", down into fender, and manually to full height, but cannot be operated downward by manual switch.	Manual antenna switch white wire open Manual antenna switch does not make contact in "Down" position	Repair white wire as necessary Check for loose connection. If secure, replace antenna switch assembly
Motor runs but antenna does not move; or only moves short distance up or down.	Drive cable slipping at engagement point inside motor housing Drive disconnected from mast Stripped drive gears inside motor housing Slipping clutch inside motor housing	Replace mast and support tube assembly Replace mast and support tube assembly Replace motor and drive assembly Replace motor and drive assembly
Motor continues to run without stopping after ignition switch is turned "OFF" and mast has secured into fender (one to five clutch clicks are normal after antenna has lowered into fender before motor stops).	Inoperative or by-passed "Down" limit switch	Replace cap and automatic switch assembly (on antenna)
With ignition and radio switches "ON", antenna extends to full height (34") before motor stops.	Inoperative or by-passed 12" limit switch	Replace cap and automatic switch assembly (on antenna)

2. Radio Noise Suppressors

a. Ignition Suppressors

Various types of ignition suppressors are used to prevent spark noise from interfering with radio reception. Failure of any of these parts to function properly is accompanied by a popping noise. The noise increases as the engine is accelerated, and varies with engine speed. If this interference is present, check the following suppressors:

1. Ignition noise is suppressed by use of resistance core ignition cables. Check for a defective cable. The resistance of these cables is 2,000 to 6,000 ohms per foot.
2. Make certain resistance spark plugs are being used to minimize ignition noise.
3. On all but Eldorados, check ground cable from negative battery cable at frame to radiator cradle.
4. On Eldorados, check ground cable between transmission housing and cowl.
5. It is particularly important that the terminals in the ignition secondary cables make good mechanical contact with the spark plug terminals and distributor cap terminals. A loose connection at these points will result in excessive ignition noise, seriously reducing FM performance.
6. A capacitor mounted on the outside of the ignition coil may be checked by running engine at medium speed and then quickly turning ignition switch to the Accessory position. If the noise is eliminated, while the engine is coasting to a stop, replace faulty coil capacitor.

b. Antenna Motor Electrical Noise

Excessive antenna motor electrical noise is often caused by the antenna lead-in cable ferrule at the antenna mast not being properly installed. This condition can be corrected by removing, cleaning if necessary, and then reconnecting the antenna lead-in cable, and tightening retaining nut.

c. Blower Motor Capacitor

A capacitor is mounted on the blower motor assembly for suppressing radio noise at high blower speeds. If the whine is eliminated when the Automatic Climate Control or heater is turned from high to a lower blower setting, this capacitor should be replaced.

3. Diagnosis Procedures

Many conditions that affect radio operation may be corrected without removing set from car. Check condition and, using diagnosis chart at front of this Section, perform the operation or operations necessary to correct the condition. If these minor repairs are not effective, radio should be removed from car and repaired at an authorized radio service station.

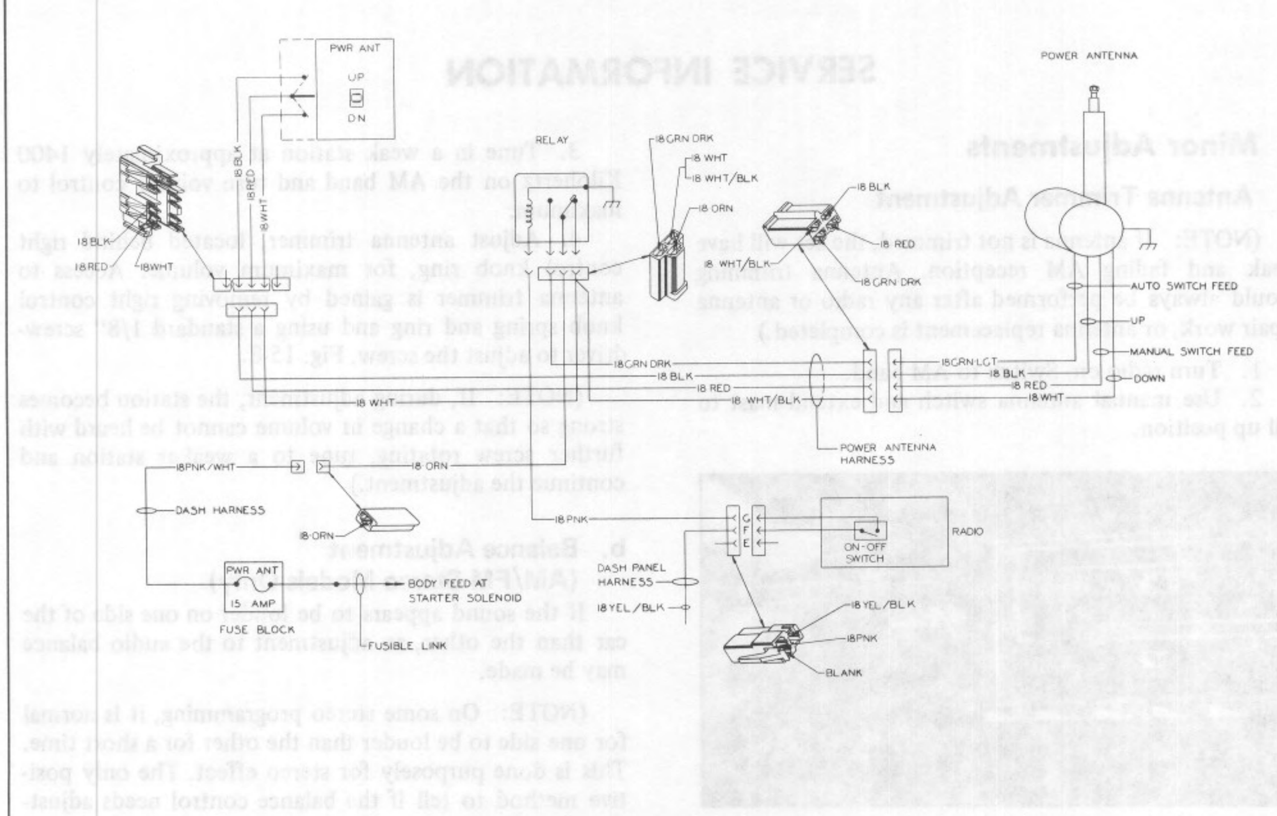


Fig. 15-7 Power Antenna Circuit Diagram

CAUTION: Do not turn on radio with any speaker disconnected, as the audio transistor may be ruined.

a. Fuse

A thump should be heard from the speakers when the radio is turned on. If thump is not heard, check fuse and replace with one of correct amperage. If fuse blows the second time on non-signal seeking receiver or signal seeking and return operation, the radio should be sent out for repairs.

b. Battery

Check battery and make sure that it is fully charged. If attempting to diagnose problems with the engine off, batteries supplying less than 9 volts will cause erroneous diagnosis of AM and FM problems.

c. Speaker Connections

Check speaker leads for possible open circuit or ground. There are four speakers with stereo installations, three with all others.

d. Electric Antenna

Use a test antenna and lead-in plugged into the set with test antenna held outside car. If radio works satisfactorily with this test assembly, car antenna should be checked for a short or ground, and lead-in should be checked for continuity. Test antenna mast for shorts to ground while wiggling antenna.

If a ground is indicated in this test, disassemble antenna and check for defective insulators or presence of water or moisture in body tube. Test with volt-ohm meter from end of either lead-in tip to ground. If lead-in test shows a ground, replace lead-in.

The conditions mentioned above will cause a weak or intermittent signal and will cause signal seeker if so equipped, to sweep back and forth across the dial when tuning bar is depressed while car is in an unusually weak signal area, such as in a building or under a viaduct.

Do not remove the set to correct this condition until all previous checks on the antenna have been made with the car in a fairly strong signal area.

e. Antenna Will Not Raise or Lower

This condition can be due to an open fuse, loose electrical connections at the switch on the receiver unit or at the antenna motor, a bent antenna mast, or a malfunctioning relay. If a check of these causes fails to correct the condition, disassemble the antenna and replace any inoperative parts.

f. Antenna Switch Test

1. Remove accessory switch panel as described in Section 12, Note 61.
2. Disconnect electrical feed wires from wiring harness.
3. Touch one lead of self-powered test light to red wire and other lead to black wire. Test light should light when switch is held in "up" position.
4. Remove test light lead from black wire and touch to white wire. Test light should now light when switch is held in "down" position.
5. If switch performs as above, remove test light and reinstall switch. If not, replace antenna switch.

SERVICE INFORMATION

4. Minor Adjustments

a. Antenna Trimmer Adjustment

(NOTE: If antenna is not trimmed, the set will have weak and fading AM reception. Antenna trimming should always be performed after any radio or antenna repair work, or antenna replacement is completed.)

1. Turn radio on. Switch to AM band.
2. Use manual antenna switch and extend mast to full up position.

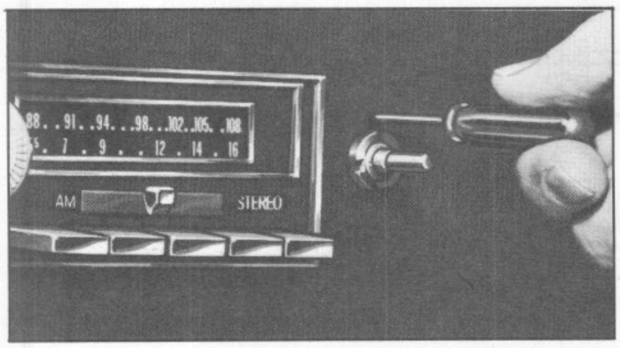


Fig. 15-8 Adjusting Antenna Trimmer

3. Tune in a weak station at approximately 1400 Kilohertz on the AM band and turn volume control to maximum.
4. Adjust antenna trimmer, located behind right control knob ring, for maximum volume. Access to antenna trimmer is gained by removing right control knob spring and ring and using a standard 1/8" screwdriver to adjust the screw, Fig. 15-8.

(NOTE: If, during adjustment, the station becomes strong so that a change in volume cannot be heard with further screw rotating, tune to a weaker station and continue the adjustment.)

b. Balance Adjustment (AM/FM Stereo Models Only)

If the sound appears to be louder on one side of the car than the other, an adjustment to the audio balance may be made.

(NOTE: On some stereo programming, it is normal for one side to be louder than the other for a short time. This is done purposely for stereo effect. The only positive method to tell if the balance control needs adjustment is to tune in a non-stereo program and make a critical evaluation, in which the owner may assist.)

If the adjustment is needed proceed as follows:

1. Turn radio on. Switch to AM band.
2. Remove left knob, spring and control ring, to gain access to stereo balance screw.
3. With fader control turned fully clockwise, insert screwdriver into balance screw, Fig. 15-9.
4. Rotate balance control adjustment clockwise or counterclockwise until the sound in the left and right speakers appears to have equal volume.
5. Install left control ring, spring and knob.

5. Stereo Tape

The only required maintenance on tape players is periodic cleaning of the tape player head. This service should be performed approximately every 100 hours of operation. The head cleaning is done by swabbing the head (unit still installed in car) with a cotton swab that has been dipped in rubbing alcohol.

No lubricants should be used since they will cause the player to operate improperly, especially at extreme temperatures.

Do not bring any magnetized tools near the tape head. If the head becomes magnetized, every cartridge played in the player will be degraded.

A test tape cartridge is available for diagnosing problems in tape players. The "Stereo 8" test tape cartridge is part #J-22683. (Test tape cartridges should always be stored in a container to keep the tape clean.)

6. Radio Receiver Unit

The procedure for removing and installing the radio receiver unit is described in Section 12, Note 54.

7. Radio Front Speaker

The procedure for removing and installing the radio front speakers is described in Section 12, Note 55.

8. Radio Rear Seat Speaker— Except Convertible

a. Removal

(NOTE: Access to rear speaker is gained through trunk compartment.)

1. Disconnect speaker lead (dark blue) from connector at rear of speaker. This is a brown lead on the AM/FM Stereo left rear speaker.

Fig. 15-9 Stereo Balance Adjustment

2. Remove four nuts securing speaker to rear filler panel and remove speaker.

b. Installation

1. Install speaker to rear filler panel and tighten four attaching nuts evenly to a maximum of 12 inch-pounds to prevent speaker distortion.
2. Connect speaker lead (dark blue) to connector at rear of speaker. This is a brown lead on the AM/FM Stereo left rear speaker.

9. Radio Rear Seat Speaker— Convertible Only

a. Removal

1. Remove two screws securing rear monitor readout to back of rear seat and remove readout.
2. Remove rear seat cushion and seat back.
3. Disconnect speaker wiring connector from speaker.
4. Remove four nuts securing speaker to speaker grille mounting studs and remove speaker assembly.

(NOTE: Convertibles without stereo use only a right rear speaker.)

b. Installation

1. Position speaker on grille mounting studs and secure with four nuts.
2. Connect speaker wiring connector to speaker.
3. Install rear seat back and seat cushion.
4. Position rear monitor readout to back of rear seat and secure with two screws.

10. Rear Seat Remote Control Unit (Fleetwood Seventy-Five Styles Only)

a. Removal

1. Remove rear seat cushion by lifting forward edge and pulling forward.
2. Remove rear seat back by removing two screws along lower edge of back and lifting assembly off mounting hooks.
3. Remove five screws securing right quarter window garnish molding and remove molding.
4. Remove six screws retaining right arm rest assembly.
5. Remove right front and rear door sill plates.
6. Remove right front kickpad.
7. Peel back rug to gain access to remote cable along right sill, and remove securing tape.
8. Remove upper instrument panel top cover as described in Section 12, Note 33a.
9. Disconnect cable assemblies at rear of radio.
10. Remove one screw and bend two clips out of way and remove cable from shroud vent duct and hinge pillar areas.
11. Thread cable through harness conduit in rear partition.
12. Loosen set screw in knob assembly and remove knob assembly, felt washers, and sensitivity ring.
13. While holding control and cable assembly in one hand, remove jamb nut securing assembly to escutcheon.

14. Route cable out of right rear quarter trim panel assembly.

b. Installation

1. Thread plug end of cable forward through hole in line with harness conduit in rear partition.
2. Route cable to radio through hinge pillar area and along shroud vent duct.
3. Connect cable assemblies at left rear corner of radio.
4. Route cable along instrument panel and install in wiring conduit. Secure with one screw and two clips.
5. Secure control and cable assembly to escutcheon with jamb nut.
6. Install sensitivity ring, felt washer, and knob assembly and tighten set screw in knob assembly.
7. Install right front kickpad.
8. Install rug and right front and rear door sill plates.
9. Install instrument panel top cover as described in Section 12, Note 33b.
10. Install right armrest assembly with six attaching screws.
11. Install right quarter window garnish molding and secure with five screws.
12. Install rear seat back on mounting hooks and secure with two attaching screws.
13. Install rear seat cushion.
14. Turn on radio and test for operation. Extend antenna fully, if so equipped, and peak antenna trimmer on weak station at approximately 1400 Kilohertz on AM band, as described in Note 4a.

11. Antenna Manual Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Section 12, Note 61.

12. Antenna Unit

a. Removal

1. Lower antenna.
2. Disconnect negative battery cable at battery.
3. Disconnect motor leads at plastic connector and antenna lead-in cable from support tube.
4. Remove two screws securing upper antenna mounting bracket to fender.
5. Remove bolt and washer securing antenna to right fender antenna mounting bracket and remove antenna from car.
6. Escutcheon may be removed by depressing lock tabs and pushing escutcheon out through top of fender.

b. Installation

1. Install escutcheon.
2. Install antenna in position.
3. Install bolt and washer securing antenna assembly to right fender, antenna mounting bracket.
4. Install two screws securing upper antenna mounting bracket to fender.
5. Connect lead-in cable to support tube. Torque nut to 65 inch pounds.
6. Connect motor leads at plastic connector.
7. Connect negative battery cable at battery.
8. Check operation of antenna.

13. Antenna Dog Assembly Replacement (Off Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.
2. Remove retaining spring clip securing automatic switch assembly to drive housing and remove switch assembly.
3. Using open end wrench, remove dog assembly from shaft by turning dog counterclockwise.

b. Assembly

1. Loosely install dog assembly on shaft by turning in clockwise direction.
2. Using template provided, measure distance between top of longest pin on dog to base of drive housing, Fig. 15-10. Adjust as necessary.
3. Position automatic switch assembly to drive housing and secure with retaining spring clip.
4. Remove antenna assembly from vise.

14. Antenna Cap and Automatic Switch Assembly Replacement (Off-Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.
2. Untape antenna wiring harness from support tube.
3. Remove retaining spring clip securing automatic switch assembly to drive housing and remove switch assembly.

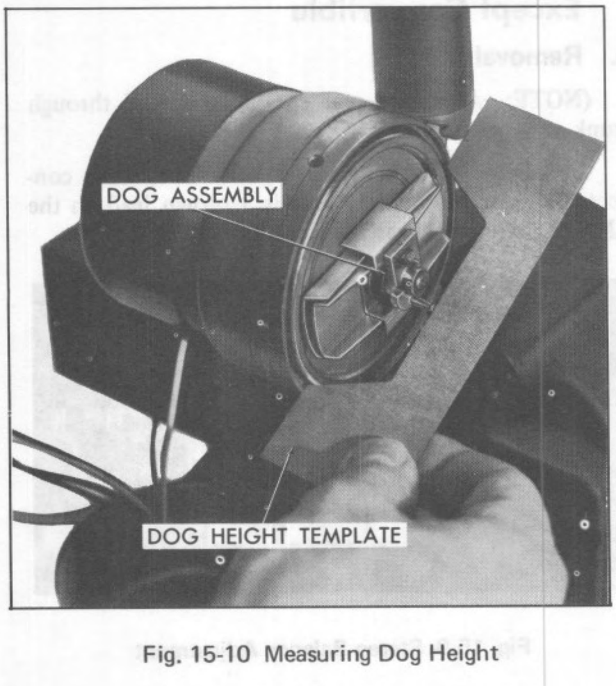


Fig. 15-10 Measuring Dog Height

4. Stagger cut black and white wires midway between motor and switch assembly and discard switch.

b. Assembly

1. Strip approximately 3/16" of insulation off black and white wires from both motor and switch leads.
2. Join leads together (black to black and white to white) and solder securely.
3. Tape solder joints with electrical tape.
4. Position automatic switch assembly to drive housing and secure with retaining spring clip.
5. Tape antenna wiring harness to support tube.
6. Remove antenna assembly from vise.

15. Antenna Motor and Drive Assembly Replacement (Off Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.
2. Untape antenna wiring harness from support tube.
3. Remove retaining spring clip securing automatic switch assembly to drive housing and remove switch assembly.
4. Using open end wrench, remove dog assembly from shaft by turning dog counterclockwise.
5. Stagger cut black and white wires midway between motor and switch assembly.

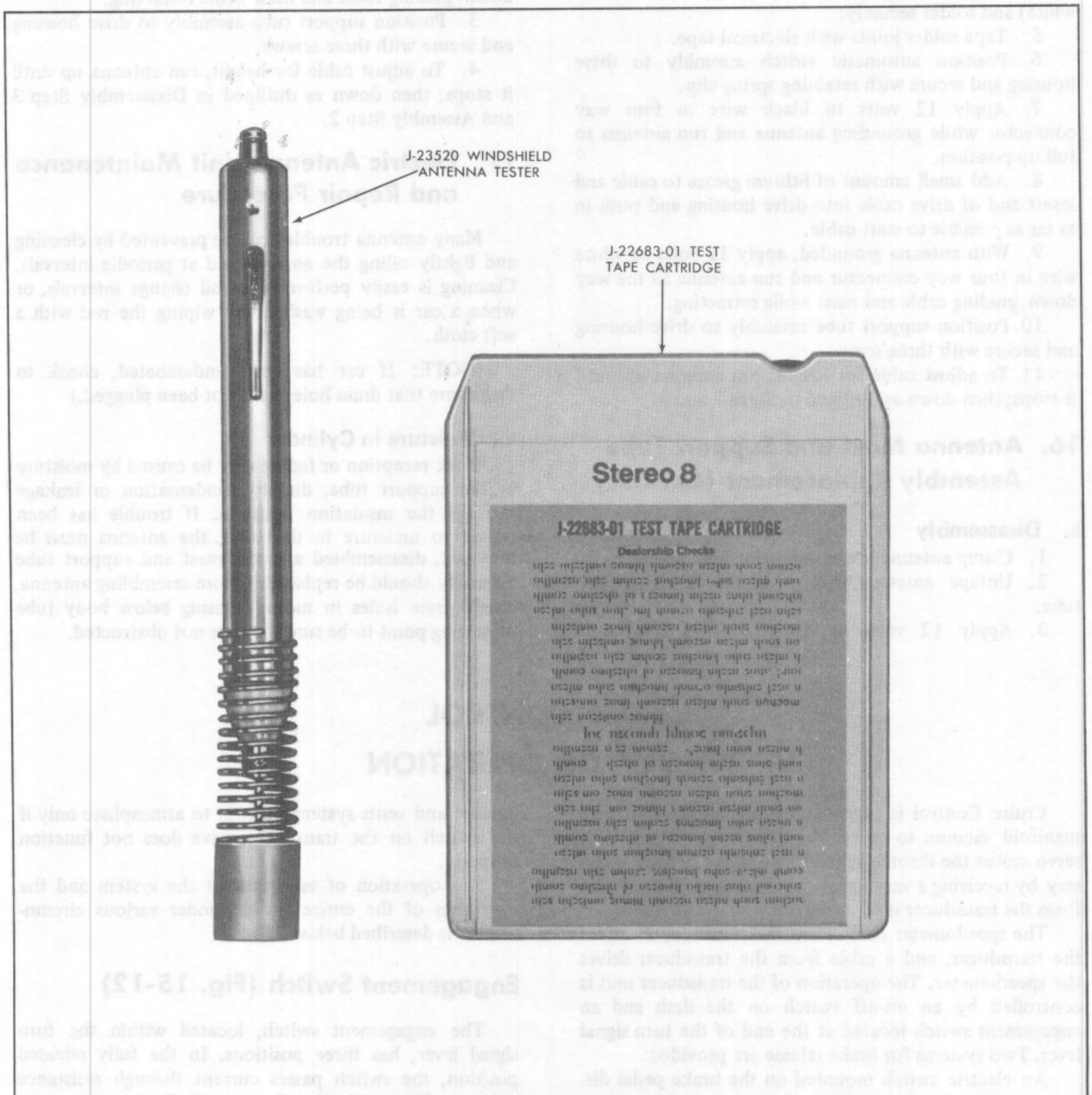


Fig. 15-11 Special Tools—Radio

6. Remove three screws securing support tube assembly to drive housing and pull support tube and drive cable completely out of drive housing.

7. Remove motor and drive assembly from vise and discard.

b. Assembly

1. Clamp new motor and drive unit mounting boss in vise.

2. Using template provided, measure distance between top of longest pin on dog to base of drive housing. Adjust as necessary.

3. Strip approximately 3/16" of insulation off black and white wires from both motor and switch leads.

4. Join leads together (black to black and white to white) and solder securely.

5. Tape solder joints with electrical tape.

6. Position automatic switch assembly to drive housing and secure with retaining spring clip.

7. Apply 12 volts to black wire in four way connector while grounding antenna and run antenna to full up position.

8. Add small amount of lithium grease to cable and insert end of drive cable into drive housing and push in as far as possible to start cable.

9. With antenna grounded, apply 12 volts to white wire in four way connector and run antenna all the way down, guiding cable and mast while retracting.

10. Position support tube assembly to drive housing and secure with three screws.

11. To adjust cable for height, run antenna up until it stops; then down as outlined in Steps 7 and 9.

16. Antenna Mast and Support Tube Assembly Replacement (Off Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.

2. Untape antenna wiring harness from support tube.

3. Apply 12 volts to black wire in four way connector while grounding antenna and run antenna to full up position.

4. Remove three screws securing support tube assembly to drive housing and pull support tube and drive cable completely out of drive housing.

(NOTE: If cable cannot be pulled out by hand, remove antenna dog as outlined in Note 13a.)

b. Assembly

1. Add small amount of lithium grease to cable and insert end of drive cable into drive housing and push in as far as possible to start cable.

2. With antenna grounded, apply 12 volts to white wire in four way connector and run antenna all the way down, guiding cable and mast while retracting.

3. Position support tube assembly to drive housing and secure with three screws.

4. To adjust cable for height, run antenna up until it stops; then down as outlined in Disassembly Step 3 and Assembly Step 2.

17. Electric Antenna Unit Maintenance and Repair Procedure

Many antenna troubles can be prevented by cleaning and lightly oiling the antenna rod at periodic intervals. Cleaning is easily performed at oil change intervals, or when a car is being washed, by wiping the rod with a soft cloth.

(NOTE: If car has been undercoated, check to make sure that drain holes have not been plugged.)

a. Moisture in Cylinder

Weak reception or fading may be caused by moisture in the support tube, due to condensation or leakage through the insulation bushings. If trouble has been traced to moisture in the tube, the antenna must be removed, disassembled and the mast and support tube assembly should be replaced. Before assembling antenna, check drain holes in motor housing below body tube mounting point to be sure they are not obstructed.

CRUISE CONTROL
THEORY OF OPERATION

Cruise Control is a speed control system that uses manifold vacuum to power the throttle servo unit. The servo moves the throttle when speed adjustment is necessary by receiving a varying amount of controlled vacuum from the transducer unit.

The speedometer cable from the transmission drives the transducer, and a cable from the transducer drives the speedometer. The operation of the transducer unit is controlled by an on-off switch on the dash and an engagement switch located at the end of the turn signal lever. Two systems for brake release are provided:

An electric switch mounted on the brake pedal disengages the solenoid in the transducer, venting system vacuum to atmosphere through the transducer filter. A vacuum dump valve is also mounted on the brake pedal bracket and vents system vacuum to atmosphere only if the switch on the transducer valve does not function properly.

The operation of each unit of the system and the operation of the entire system under various circumstances is described below.

Engagement Switch (Fig. 15-12)

The engagement switch, located within the turn signal lever, has three positions. In the fully released position, the switch passes current through resistance wire to effect a "hold in" magnetic field in the transducer solenoid. This current is sufficient only to hold the solenoid in place once it has been actuated by the

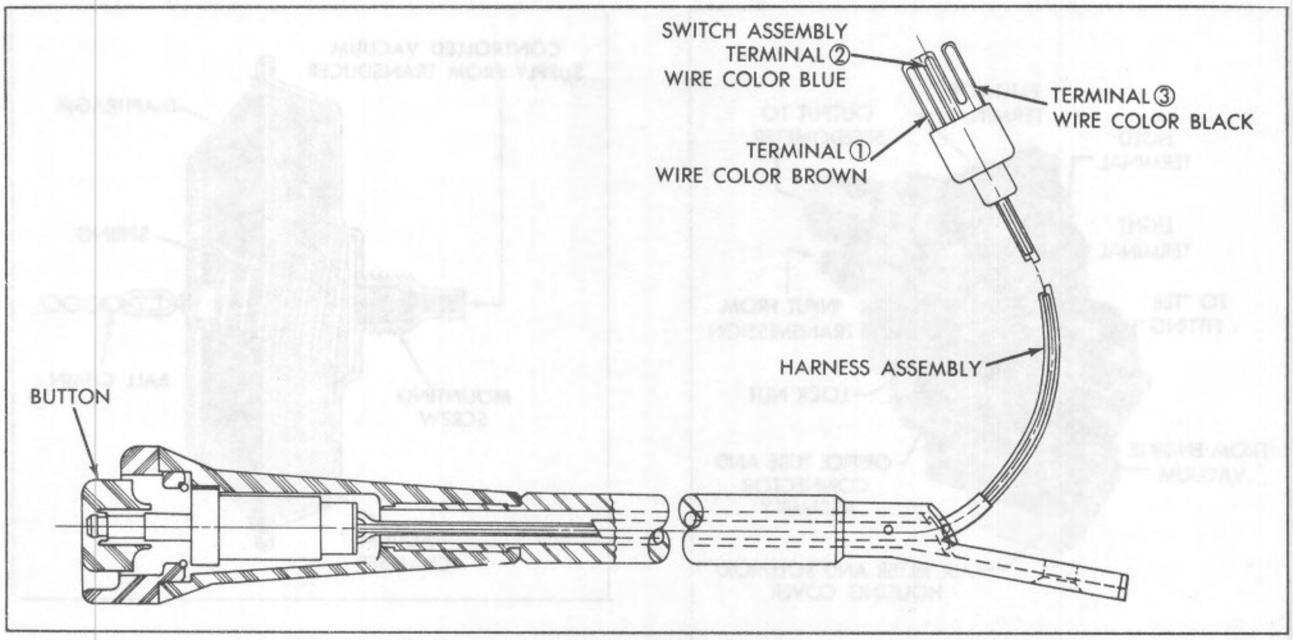


Fig. 15-12 Engagement Switch

"pull in" circuit. Depressing the button partially allows current to flow to the transducer solenoid at full voltage by-passing the resistance, which causes the solenoid to pull in. Depressing the button fully opens the circuit to both the resistance and standard solenoid feed wires and the solenoid becomes de-activated.

During vehicle operation the three switch positions have the following functions:

a. Switch in Free Position (On-Off Switch "ON")

1. System not engaged: No function of the system will occur although a small current is flowing through the solenoid via the resistance wire.

2. System engaged: The small current flowing through the resistance wire is holding the solenoid in the engaged position.

b. Switch Partially Depressed (On-Off Switch "ON")

Full voltage is applied to the solenoid by-passing the resistor which sets the transducer to maintain the vehicle speed at the time of transducer engagement.

c. Fully Depressed (On-Off Switch "ON")

No current flows to the solenoid and the transducer is inactive. This position is used by the driver when he desires to raise or lower his controlled speed. He may accelerate to his new speed, press the button fully (transducer releases previously set speed) and release the button. Upon releasing the button, current passes through the partially depressed position and the solenoid is "pulled in", then into released position which provides "hold in" current. The driver may also press the button fully with no pressure on the accelerator pedal. In this case the transducer releases control of the throttle which returns to idle and the car slows. When the button is released the solenoid is pulled in and held in respectively and the transducer resumes speed control at the speed of the vehicle during the moment of button release (at vehicle speeds over 24 mph).

On-Off Switch

This switch is located to the left side of the steering column. The toggle switch completely controls the electrical power to the Cruise Control system. When the switch is in the "OFF" position, the system cannot be engaged. When the switch is in the "ON" position, the "ON" light is lit and the system may then be engaged with the switch located within the turn signal lever, at any speed above approximately 24 mph.

Brake Release Switches

One brake release switch and one vacuum release valve are employed in the Cruise Control system. When the brake pedal is depressed, an electric release switch cuts off the voltage supplied to the engagement switch, cutting off power to the transducer unit. The transducer is then disengaged and requires engagement switch operation to return it to operation. A vacuum release valve operates after the electric release switch whenever the brake pedal is depressed. In case the electrical switch fails to operate, this switch opens a port to atmospheric pressure that dumps the vacuum in the servo unit thereby returning the throttle to the idle position, as long as the brake is depressed.

Servo Unit

The servo unit is a vacuum actuated, variable position diaphragm assembly that operates the carburetor throttle when the system is in operation. It is powered by controlled vacuum from the transducer and operates the throttle linkage via a bead chain. The servo has a port on the sealed side of the diaphragm housing. When controlled vacuum is applied to this port, atmospheric

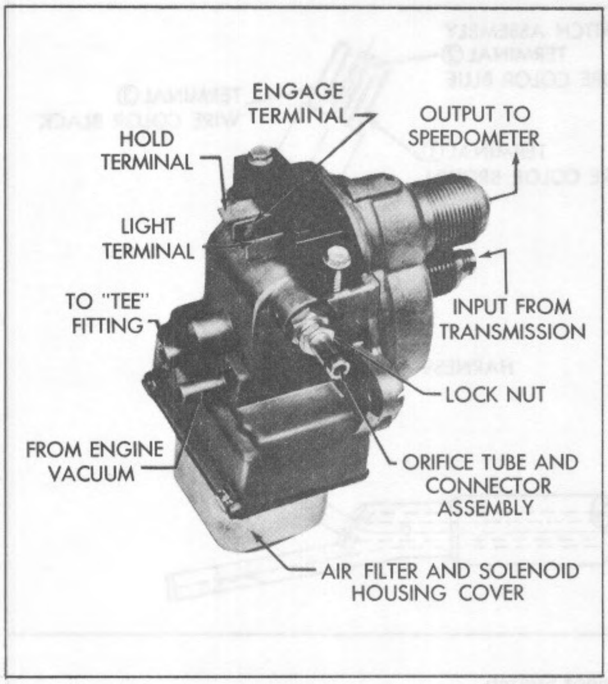


Fig. 15-13 Transducer

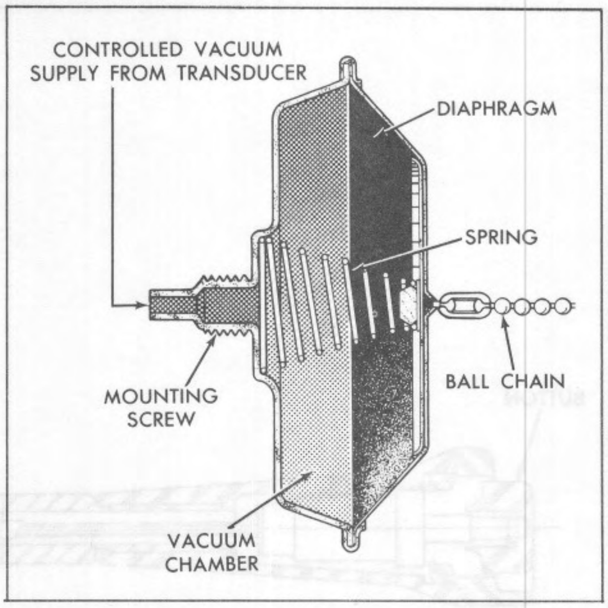


Fig. 15-14 Servo Unit

pressure moves the diaphragm which pulls on the bead chain opening the carburetor throttle.

Transducer

The transducer is located on the cowl near the centerline of the car. The device has two primary functions which are controlled by the pull-in of the solenoid. First, it is a vacuum switch which, when engaged by the driver, supplies vacuum to a "Tee" fitting. Second, it allows the metering valve clutch spring to grasp the rubber clutch which is fixed to the speed cup spindle assembly. A variation in vehicle speed results in a slight rotation of the rubber clutch which in turn moves the air valve which meters a small variable quantity of air to the system where it blends with vacuum, thus providing the servo unit with controlled vacuum that will maintain the selected speed. In operation, at cruise speed, a proper balance of air and vacuum is blended into the system and is imposed upon the servo unit to maintain an "on speed" cruise condition. See Figs. 15-13 and 15-14.

An additional function of the transducer is to drive the speedometer. The speedometer cable from the transmission which drives the transducer speed sensing assembly also is directly geared (at a one-to-one ratio) to a second cable connected to the instrument panel speedometer.

The transducer is electrically engaged and disengaged through operation of the engagement switch, on-off switch, and the electric brake release switch. Two subassemblies make up the unit: one being the magnetic speed sensing assembly and the other the solenoid actuated vacuum switch, air bleed and filter, and low limit speed switch assembly. See Fig. 15-15.

a. Magnetic Speed Sensing Assembly

The speed sensing assembly operates in the same manner as a speedometer unit except that instead of rotating a needle through an angle proportional to vehicle speed, it rotates a rubber drum which is clutched to the air bleed valve when the system is in operation.

The assembly is driven by the speedometer cable from the transmission which rotates a disk shaped ferrite magnet. Facing the magnet is the driven disk which is mounted to the same shaft as the rubber drum. A spiral hairspring is connected to the driven shaft and is calibrated to allow an angular rotation of the rubber drum which is proportional to car speed. If the car doubled its speed, the shaft would rotate to twice its previous angle as may be seen by noting the operation of a speedometer. The driven disk is sandwiched between the magnet and a field plate. The field plate forms a returning path for the magnetic field from the magnetic disk.

b. Vacuum Switch, Air Bleed and Filter, and Low Limit Speed Switch

The speed sensing assembly has a rubber drum which extends into the air bleed metering assembly. This rubber drum has a tang extending from its surface. When the car reaches about 24 mph, the tang has rotated enough (moved by the driven disk in the magnetic field) to allow a spring loaded electrical contact to close. This contact is in series with the solenoid coil so that below approximately 24 mph, no transducer operation is possible.

Surrounding the rubber drum is a "U" shaped spring clip which is held spread away from the drum by the nose of the solenoid when the solenoid is in the relaxed position. The rubber drum and "U" clip comprise the speed clutch of the transducer. When energized, the solenoid nose moves toward the drum and releases the clip ends which are then free to spring inward and clamp itself by friction to the drum. Now, any change in car speed will rotate the drum and move the "U" clip just as a speedometer moves its needle. The top of the "U" clip is attached to the air bleed valve, which slides on the orifice tube and covers or uncovers air ports in the wall

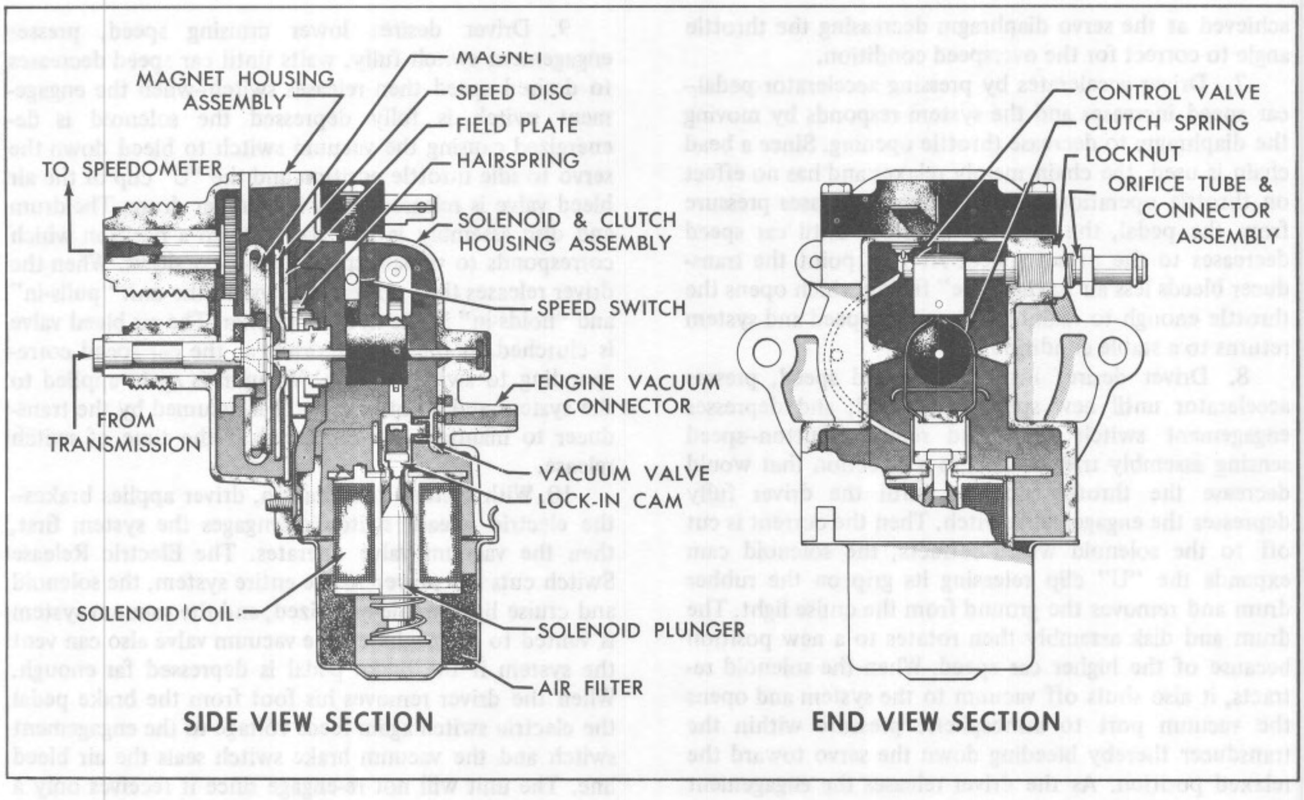


Fig. 15-15 Transducer Cross Section

of the tube (the tube inner end is plugged) whenever car speed changes from the speed at which the solenoid was energized. The direction of drum rotation is such that resulting bleed valve operation will cause the servo to decrease engine power if the car exceeds the preset speed and increase engine power if car speed decreases. The air which passes out the orifice tube enters the transducer through the openings in the solenoid housing, passes through the oil wetted polyurethane filter, and then enters the orifice tube ports.

When the solenoid is de-energized, the nose retracts and forces the ends of the "U" clip outward so that the rubber drum is released.

Simultaneously with the clutching and declutching of the "U" clip, the solenoid operates a vacuum valve which slides over two ports in the transducer wall. When the solenoid is de-energized, the slide valve seals the manifold vacuum port and opens the system port to atmospheric pressure inside of the transducer case. When the solenoid is energized, the valve overlaps the two ports and connects manifold vacuum to the control system.

During system operation the following events occur:

1. Car speed below 24 mph--the solenoid pull-in circuit cannot function because the rubber drum has not rotated far enough to close the low speed solenoid contact. The solenoid is receiving a small current via the 40 ohm resistance wire unless the brake pedal is depressed, engagement switch is fully depressed, ignition switch is Off, or On-Off switch is Off.

2. Car speed above 24 mph--the tang on the rubber drum has rotated enough to allow the low speed solenoid contacts to close. The pull-in circuit is now ready for engagement.

3. Driver partially depresses engagement switch--full current flows through the solenoid to pull it into operation, releasing the "U" clip which permits the clip's spring tension to grip the rubber drum. Also the solenoid plunger completes the ground for the Cruise light on the driver's control. Simultaneously, the vacuum switch applies manifold vacuum to the system which is blended with air being introduced from the transducer. The balance of air and vacuum is impressed upon the servo to provide initial throttle positioning.

4. Driver releases the engagement switch--current flows to the solenoid through the 40 ohm wire and since the solenoid is "pulled in", the reduced current flow is sufficient to hold it in position and the cruise light remains On.

5. The car begins to ascend a hill--car speed decreases very slightly and the magnetic force on the driven disk of the speed sensor is decreased thereby reducing the angle of rotation of the rubber drum slightly. Since the "U" clip is gripping the drum, it moves the air bleed valve in that direction which covers more of the air bleed ports. With less air bleeding into the system, a higher vacuum level is achieved at the servo diaphragm, opening the throttle angle to correct for the underspeed condition.

6. The car begins to descend a hill--car speed increases slightly and the air bleed valve moves in that direction which uncovers the air bleed ports. With more air bleeding into the system, a lower vacuum level is

achieved at the servo diaphragm decreasing the throttle angle to correct for the overspeed condition.

7. Driver accelerates by pressing accelerator pedal--car speed increases and the system responds by moving the diaphragm to decrease throttle opening. Since a bead chain is used, the chain merely relaxes and has no effect on throttle operation. After the driver releases pressure from the pedal, the throttle will close until car speed decreases to the preset speed. At that point the transducer bleeds less air to the "Tee" fitting which opens the throttle enough to maintain the preset speed and system returns to a stable condition.

8. Driver desires higher controlled speed, presses accelerator until new speed is reached, and depresses engagement switch fully and releases button--speed sensing assembly tries to turn in a direction that would decrease the throttle opening until the driver fully depresses the engagement switch. Then the current is cut off to the solenoid which retracts; the solenoid cam expands the "U" clip releasing its grip on the rubber drum and removes the ground from the cruise light. The drum and disk assembly then rotates to a new position because of the higher car speed. When the solenoid retracts, it also shuts off vacuum to the system and opens the vacuum port to atmospheric pressure within the transducer thereby bleeding down the servo toward the relaxed position. As the driver releases the engagement switch, "pull-in" and "hold-in" of the solenoid occur. The system is now engaged to maintain the car speed at the time of engagement switch release and the cruise light is on.

9. Driver desires lower cruising speed, presses engagement switch fully, waits until car speed decreases to desired speed then releases switch--when the engagement switch is fully depressed the solenoid is de-energized causing the vacuum switch to bleed down the servo to idle throttle position and the "U" clip of the air bleed valve is released from the rubber drum. The drum and disc assembly is free to rotate to a position which corresponds to vehicle speed as the car slows. When the driver releases the engagement switch, the unit "pulls-in" and "holds-in" in the normal manner. The air bleed valve is clutched to the rubber drum at the car speed corresponding to switch release. Vacuum is again applied to the system and throttle control is assumed by the transducer to maintain the car speed at the time of switch release.

10. With system in operation, driver applies brakes--the electric release switch disengages the system first, then the vacuum valve operates. The Electric Release Switch cuts off power to the entire system, the solenoid and cruise light are de-energized, and the vacuum system is vented to atmosphere. The vacuum valve also can vent the system if the brake pedal is depressed far enough. When the driver removes his foot from the brake pedal the electric switch again feeds voltage to the engagement switch and the vacuum brake switch seals the air bleed line. The unit will not re-engage since it receives only a small current through the 40 ohm resistance wire. If vehicle speed is below 24 mph the system may not re-engage since the tang on the rubber drum has opened the low limit switch points in the transducer.

DIAGNOSIS

18. Release Switches

Before any diagnosis of transducer operations, check the Cruise Control electric brake release switch adjustment. This switch must make contact in free position and break the electrical contact when the brake pedal is depressed 1/4 - 5/8 inch; but in any case it must be adjusted to disengage the system before the vacuum dump valve, otherwise a "hiss" will be heard inside the car when the brakes are applied.

A brief check of the electrical brake release switch is as follows:

1. Disconnect two-way connector on top of transducer.

2. Turn connector and install on terminal so that black wire terminal is temporarily connected to transducer "Hold" terminal. The other terminal will be empty.

3. With ignition switch on, move Cruise Control switch to ON.

4. Engage switch in turn signal lever, push button part way in (about 1/2 way) and hold. Green jewel next to "CRUISE" should light.

5. Depress brake pedal 1/4" to 5/8" while holding lever button depressed. "CRUISE" light should go out. If light goes out before 1/4" travel or if light did not go on, the electric brake release switch at the brake pedal lever should be re-adjusted.

6. Turn ignition off, and adjust release switch as required. Adjust switch by loosening switch mounting screw, repositioning switch and tightening screw.

7. Re-install two-way transducer connector on its proper terminals. It is imperative that this step be performed.

As a "back-up" release, in case the electric switch should not operate for any reason, the vacuum brake release valve should disengage the system when the brake pedal is depressed over 1" of pedal travel. This will not de-energize the system; the "on-off" switch or ignition switch must be turned off when the car is stopped to disengage the system electrically.

This valve can easily be checked by:

(a) temporarily removing the smaller vacuum hose from the left front of the transducer,

(b) removing the hose to the dump valve from the die-cast "tee,"

(c) connecting the two hoses together, so that engine vacuum is applied to the dump valve.

With the engine running a "hiss" should be heard when the brake pedal is depressed over 1". To adjust the dump valve, push valve all the way into the retaining

clip. Pulling the brake pedal up to the stop will automatically adjust the valve.

Make sure both hoses are reinstalled properly, when test is completed.

19. Electrical System Check-Out (Fig. 15-16)

1. Check fuse and connector.

2. To check the cruise light circuit, refer to electrical schematic and

(a) Turn ignition switch and cruise control switch on.

(b) Connect a jumper lead between light terminal connector on transducer and ground.

(c) If cruise light comes on, transducer replacement is indicated. If cruise light does not come on, check bulb, cruise light wiring and/or connections.

3. Check electric brake switch as follows: Unplug connector at switch. Connect ohmmeter or self powered test light at two terminals on brake switch. The ohmmeter must indicate infinity when the pedal is depressed from 1/4″ to 5/8″ travel and continuity when pedal is released. Replace electric brake switch if needed.

4. Check engagement switch and connecting wiring as follows: Unplug engagement switch connector (brown, dark blue, black) at electrical wiring harness connector and perform the following tests. (See Fig. 15-16.)

a. **Test #1** – Connect ohmmeter between terminal #1 (brown wire) and terminal #2 (dark blue wire). Con-

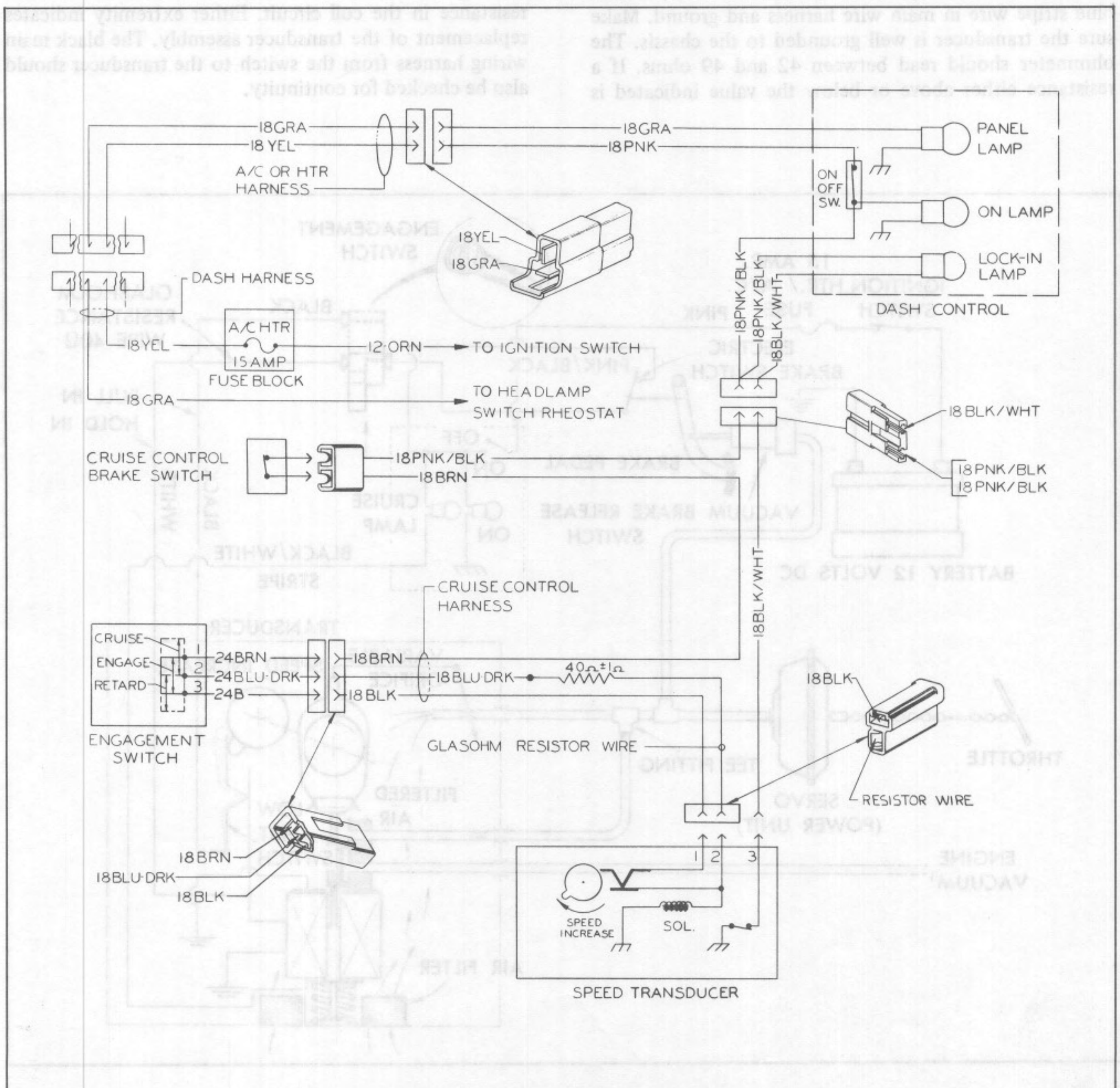


Fig. 15-16 Cruise Control Electrical Diagram

tinuity should be maintained until switch is depressed all the way in.

b. Test #2 – Connect ohmmeter between terminal #1 (brown wire) and terminal #3 (black). No continuity should be shown; however, when the button is depressed halfway, continuity should be indicated. When the button is depressed all the way down, no continuity should be shown.

c. Test #3 – Connect ohmmeter between terminal #2 (dark blue wire) and terminal #3 (black). Button released, no continuity; however, when the button is depressed partially and fully, continuity should be shown.

5. Disconnect engagement switch wire harness connector from the main harness connector (brown, dark blue, and black wires). Connect ohmmeter between dark blue stripe wire in main wire harness and ground. Make sure the transducer is well grounded to the chassis. The ohmmeter should read between 42 and 49 ohms. If a resistance either above or below the value indicated is shown, then disconnect the connector from the transducer and measure the resistance of the white resistor wire. It should measure 40 ohms ± 2 ohms. If a resistance either above or below the value indicated is shown, the main wiring harness should be replaced.

(NOTE: When disconnecting or reconnecting the main wiring harness connector from the transducer, care should be exercised not to damage the blade connectors or the wiring harness. The disconnect may be facilitated by prying carefully on the plastic connector with a small bladed screwdriver.)

When measuring the solenoid coil circuit resistance between the hold terminal and ground, the ideal ohmic resistance should be between 5 and 6 ohms. A reading of less than 4 ohms indicates shorting in the coil circuit. A reading of more than 7 ohms indicates excessive resistance in the coil circuit. Either extremity indicates replacement of the transducer assembly. The black main wiring harness from the switch to the transducer should also be checked for continuity.

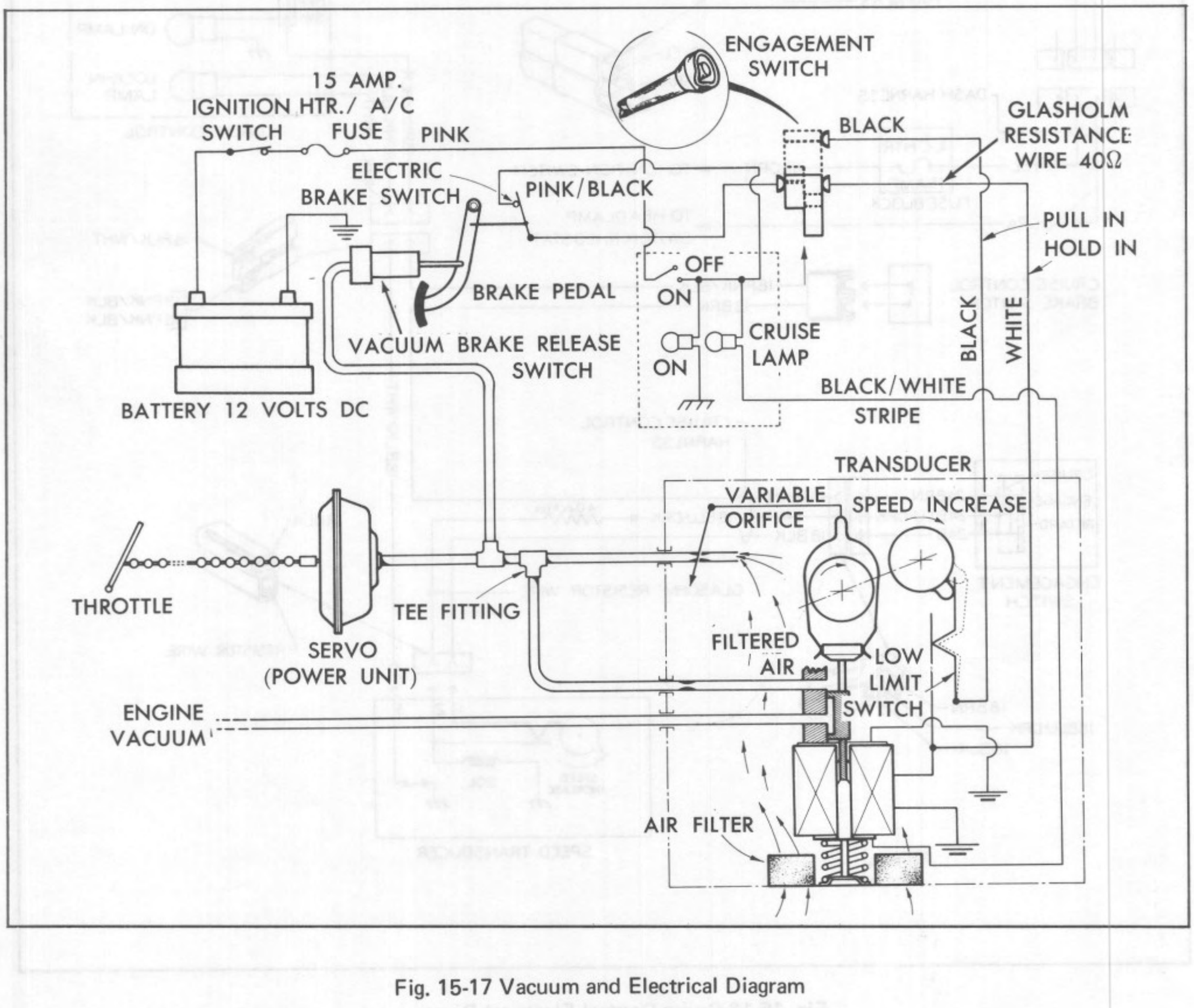


Fig. 15-17 Vacuum and Electrical Diagram

CRUISE CONTROL DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Will not engage - System Inoperative.	On-Off switch "off".	Turn to "on" position.
	Brake switch circuit open.	Check connections - adjust or replace switch. Refer to Electrical Check-Out.
	Fuse blown.	Replace fuse - if it blows again, check for: 1. Incorrect wiring - Refer to Electrical Check-Out. 2. Short to ground - Refer to Electrical Check-Out.
	Chain from servo to carburetor disconnected.	Connect chain.
	Inoperative engagement switch.	Replace as needed - Refer to Electrical Check-Out.
	Vacuum leak in servo and/or brake valve and connecting lines. Vacuum hose not connected to vacuum valve.	Vacuum test and repair or replace as needed. Refer to Servo and Vacuum System Check-Out.
	Vacuum release valve misadjusted (always open).	Readjust valve.
	Crossed hoses at transducer.	Reroute hoses.
	Pinched or plugged hose that is connected to the servo.	Free or replace hose.
	Open in wiring harness.	Repair or replace as needed.
	Inoperative transducer.	Replace transducer.
Does not cruise at engagement speed.	Orifice tube misadjusted.	Adjust as required.
System hunts, pulses, or surges.	Kinked or deteriorated hoses (air leak).	Repair or replace.
	Malfunctioning and/or improperly positioned drive cables and/or casing assemblies.	Repair or replace as needed.
	Malfunctioning transducer.	Replace transducer.
System does not disengage - with brake pedal.	Brake switch misadjusted or inoperative.	Adjust or replace as required. Refer to Servo and Vacuum System Check Out and Electrical Check Out.
System steadily accelerates or applies full throttle when engaged.	Manifold vacuum connected directly to servo.	Reroute hose.
	Malfunctioning transducer.	Replace transducer.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd)

CONDITION	CAUSE	CORRECTION
Cannot adjust speed downward with engagement button.	Malfunctioning engagement switch or wiring.	Replace as needed. Refer to Electrical Check-Out.
Does not engage or engages lower than limits referred to in "Driver Operation". Low Speed Engagement can be as low as 20 MPH.	Malfunctioning transducer.	Replace transducer.
System operates correctly, but constant vacuum bleed when system is disengaged.	Crossed vacuum hoses at transducer.	Reroute hoses.
System can be engaged at idle by depressing switch, but will drop out when switch is released. Solenoid can be heard when switch is depressed when the vehicle is standing still.	Wires reversed at transducer.	Reverse wires - See Fig. 15-16.
On light will not turn on even though system cruises satisfactorily.	Inoperative bulb.	Replace.
Cruise light will not turn on even though system cruises satisfactorily.	Inoperative bulb or poor ground circuit in transducer.	Replace bulb check cruise light wiring and/or connections or replace transducer.

BUTTON POSITION	TERMINALS		
	1 to 2	1 to 3	2 to 3
Cruise (released)	closed	open	open
Engage (Partially depressed)	closed	closed	closed
Trim (fully depressed)	open	open	closed

20. Servo and Vacuum Check-Out (Fig. 15-17)

To determine the condition of the diaphragm, remove hose from servo unit and apply 14 inches of vacuum to the tube opening and hold in for one minute. The vacuum should not leak down more than 5 inches of vacuum in one minute. If leakage is detected, replace servo. To utilize engine as a vacuum source, proceed as follows:

1. Disconnect servo bead chain and hose from servo then connect engine vacuum directly to the servo fitting.
2. Note position of servo diaphragm.
3. Start engine - the diaphragm should pull in.
4. Clamp off engine vacuum supply line and check for leakage.

The cruise release brake switch (vacuum) and connecting hoses can likewise be checked using a vacuum pump.

SERVICE INFORMATION

The components of the Cruise Control system are designed to be replaced should they become inoperative.

The transducer is calibrated in such a manner during manufacturing that overhaul operations are impractical. However, one adjustment may be made to the transducer to correct speed drop or increase at the time of engagement. (Refer to Note 24b and 24c.)

21. Brake Release Switch and Vacuum Dump Valve

a. Electric

Service – An inoperative switch must be replaced. Install new switch and adjust by loosening switch mounting screw, repositioning switch, and tightening screw.

Adjustment – With ignition and Cruise Control on, use a test light from the terminal with brown wire to ground. The brake switch must break the electrical contact when the pedal is depressed approximately 1/4 - 5/8 inch, but in any case it must be adjusted to disengage the system before the dump valve, otherwise a hiss will be heard inside the car when the brakes are applied.

b. Vacuum

Service – An inoperative (sticking, plugged, or leaking) valve must be replaced. Be certain that the hose to the switch is connected firmly and is not cracked or deteriorated.

Adjustment – The vacuum valve should be pushed all the way into the retaining clip. Pulling the brake pedal up to the stop will automatically adjust valve.

22. Engagement Switch

The engagement switch cannot be serviced. The complete turn signal lever must be replaced as an assembly.

a. Removal

1. Disconnect battery ground cable.
2. Remove steering column lower cover and slide column harness protector down out of way.
3. Disconnect cruise control switch harness connector and attach a long piece of piano wire to switch connector.
4. On T & T steering columns, perform the following:
   a. Before unscrewing the turn signal lever, make a small hook in a thin piece of stiff wire.
   b. Insert wire in turn signal lever opening.
   c. Using wire, gently pull Cruise Control harness out through opening.
   d. Gently pull remainder of harness up through and out of column.
   e. Disconnect guide wire from connector and secure wire to column.

   (NOTE: Wire must be used so that Cruise Control harness can be guided through the proper passages on installation.)

   f. Unscrew turn signal lever, being sure to pass Cruise Control harness over the lever each time the turn signal lever makes one complete turn.
   g. Remove turn signal lever from car.
5. On standard steering columns, proceed as follows:
   a. Remove steering wheel as described in Section 9, Note 27a.

   CAUTION: When laying wheel facing down, place a cloth on work bench to prevent wheel from being scratched or marked.

   b. Remove three screws securing lock plate cover assembly to lock plate and remove cover assembly, Fig. 9-76.
   c. Working through lock plate, remove screw securing turn signal lever and remove lever and harness. Pull harness up gently so guide wire can be used to install new unit.
6. On Air Restraint Steering columns, proceed as follows:

   (a) through (e) and Note; same as used on T & T columns.

   (f) Insert thin bladed screwdriver into column hole along turn lever and beneath turn signal switch retainer.

(g) Apply upward force on screwdriver to disengage spring locking tang, then pull lever out of retaining clip.

b. Installation

1. Attach upper end of piano wire to switch harness connector and pull piano wire at lower end of column, feeding harness into proper location in column.

2. On T & T steering columns, perform the following:

a. Gently pull harness down through steering column cover part way.

b. Allow Cruise Control lever to hang free, with approximately 16" of wire out of column. Then, rotate turn signal lever in a counterclockwise direction six times, permitting Cruise Control harness to make six loops.

c. Insert turn signal lever into opening in column.

d. Screw turn signal lever into position.

(NOTE: The wire loops will unwind as the lever is screwed in and wires will be straight in the column.)

e. After lever is installed, gently pull remainder of harness through column and into position.

3. On standard steering columns, proceed as follows:

a. Position turn signal lever on turn signal switch. Working through lock plate, secure lever to switch with one screw. Tighten screw to 20 inch-pounds.

b. Position cover assembly on upper end of column and install three screws securing cover to lock plate.

c. Install steering wheel as described in Section 9, Note 27b.

d. Remove guide wire from switch harness.

4. On Air Restraint steering columns, proceed as follows:

(a) Same as T & T.

(b) Insert turn signal lever through column opening into retaining clip, making sure lever is fully inserted and clip locking tab engaged to prevent accidental removal.

(c) Same as (e) on T & T.

5. Disconnect piano wire from switch harness and reconnect harness.

6. Slide column harness protector up into position and install column lower cover.

7. Connect battery ground cable.

23. Servo

a. Service

If the servo unit is found to be inoperative, replacement is required. Note the condition of the hoses and replace any which are cracked or deteriorated.

b. Adjustment

Install the bead chain with second ball on the inboard slot of the throttle plate clip.

24. Transducer

a. Maintenance

A malfunctioning transducer (one which is not simply out of adjustment) must be replaced. During replacement, check the hoses which connect to the transducer and replace any which are cracked or deteriorated.

b. Adjustment

One transducer adjustment is possible: Engagement - Cruising Speed Zeroing (to remove any difference between engagement and cruising speed). No transducer adjustment should be made, however, until the following items have been checked or serviced:

1. All hoses in good condition, properly attached, not leaking, not pinched or kinked.

2. Electric and vacuum release switches properly adjusted.

c. Engagement—Cruising Speed Zeroing

If the cruising speed is lower than the engagement speed, loosen the orifice tube locknut (see Fig. 15-13) turn the tube outward; if higher, turn the tube inward. Each 1/4 turn will alter the engagement-cruising speed difference one mph. Tighten the locknut after adjustment and check the system operation at 60 mph.

GUIDE-MATIC THEORY OF OPERATION

The Guide-Matic is an optional convenience item that allows the driver to obtain automatic switching of vehicle headlight beams in response to light from approaching vehicle headlights. Provision is included for the driver to obtain manual control or constant low beam if desired.

The system consists of a photo-amplifier, power relay, foot switch, sensitivity control (driver control), and interconnecting wire harness, Fig. 15-18.

The photo-amplifier combines a light sensing photocell and transistorized D.C. amplifier into one unit with sufficient power to operate a power relay for switching the headlight beams. Mounting location is below the radiator cradle tie bar just to left of car center, positioned so the amber colored lens has an unobstructed view of approaching vehicle headlights through the grille. Road signs, reflections from the vehicle's own headlights, and other miscellaneous lights require the vertical and horizontal "viewing range" of the photocell to be rather narrow. Since the "viewing range" is narrow, aim of the photo-amplifier is very important. An adjustment screw and aiming level for setting correct vertical aim are integral parts of the unit. Instructions for aiming must be followed carefully for correct operation.

The photo-amplifier is adjusted and sealed at the factory. If a failure occurs, the assembly must be replaced. A model-serial number label is attached on the rear of the assembly for field identification.

The power relay is a sealed, single pole, double throw, 12 volt D.C. relay which provides the heavy-duty

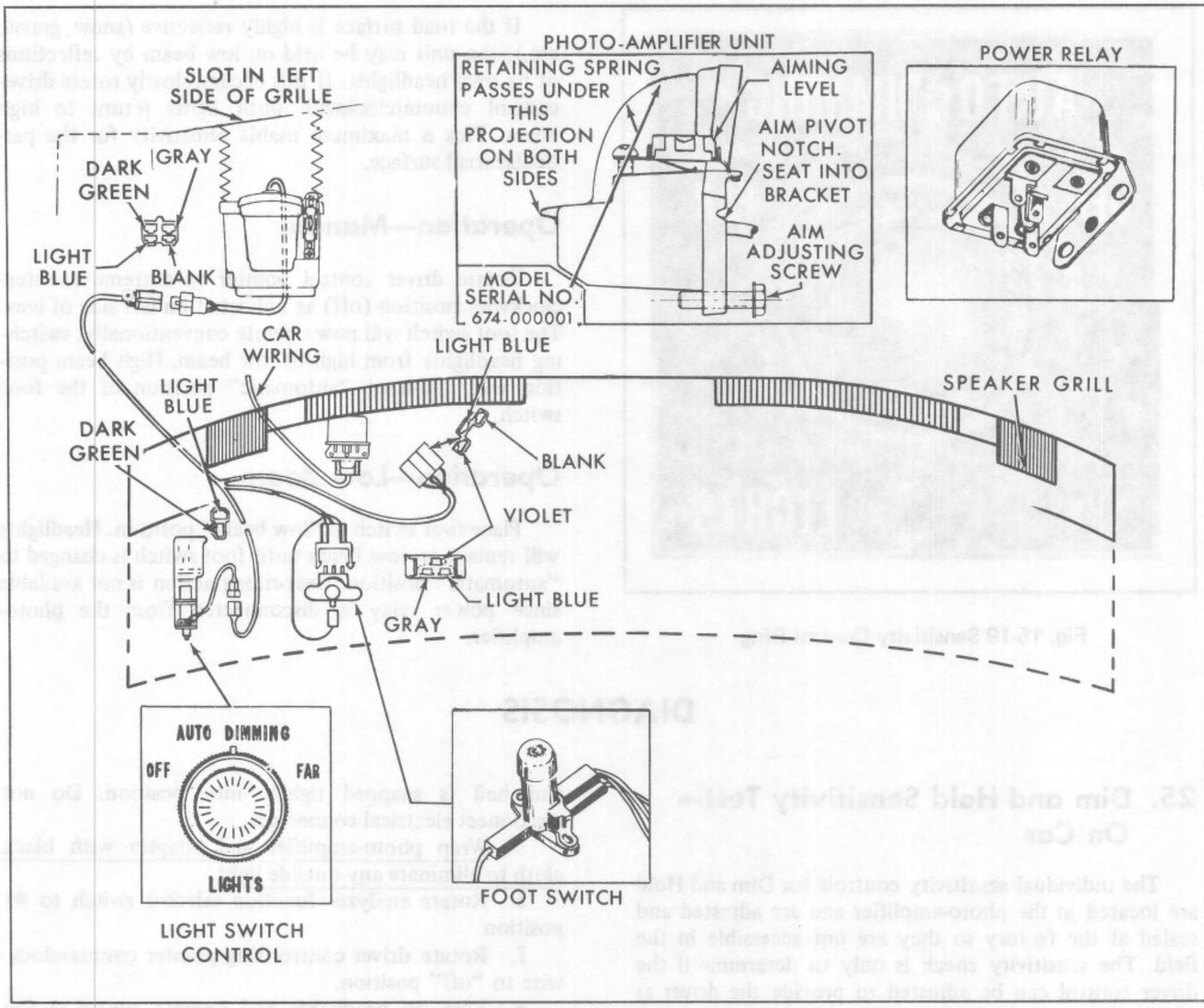


Fig. 15-18 Guide-Matic Components

contacts for switching the headlight beams. The high beams are connected to the "normally closed" contacts. The relay is mounted under the carpet on the toe pan just above the foot switch.

The foot switch is the same as the regular foot dimmer switch except for an added "momentary contact" grounding circuit. Operating the switch in the normal manner provides either "automatic" control of headlight beams or "low beam" only. In "automatic" position, a slight pressure on top of the switch closes the grounding circuit to provide an "overriding" high beam (regardless of light on the photo-amplifier) for signalling purposes or to determine "automatic" position.

The sensitivity control (driver control) is located directly behind and is concentric with the headlight switch knob. Rotating the ring pointer provides a range of sensitivity and is the only means of adjusting sensitivity in the field, Fig. 15-19.

Operation—Automatic

Turn headlights on, rotate driver control ring pointer to approximately center of rotation, and place foot switch in "automatic" position. If there is no light ahead, the headlights will be on high beam. No warm-up time is required.

When light from an approaching vehicle's headlights reaches a predetermined level at the photocell's sensing surface, the amplifier will trigger (pull-on) the power relay causing it to switch (dim) the headlights from high to low beam. At the same time the photocell sensitivity is increased to "hold" sensitivity to keep headlights on low beam when approaching driver reduces light by switching to low beam.

If the driver desires his lights to switch when the approaching vehicle is farther away or nearer, he may adjust the driver control. Also if the approaching driver fails to dim, he may signal him by momentarily putting a slight pressure on top of the foot switch to "override" his headlights to high beam. When he removes the pressure, his headlights will revert to low beam if there is still sufficient light ahead.

When the approaching car passes and light is removed from the photocell, the amplifier removes the signal voltage from the power relay coil, causing it to "drop out" and switch back to high beam.

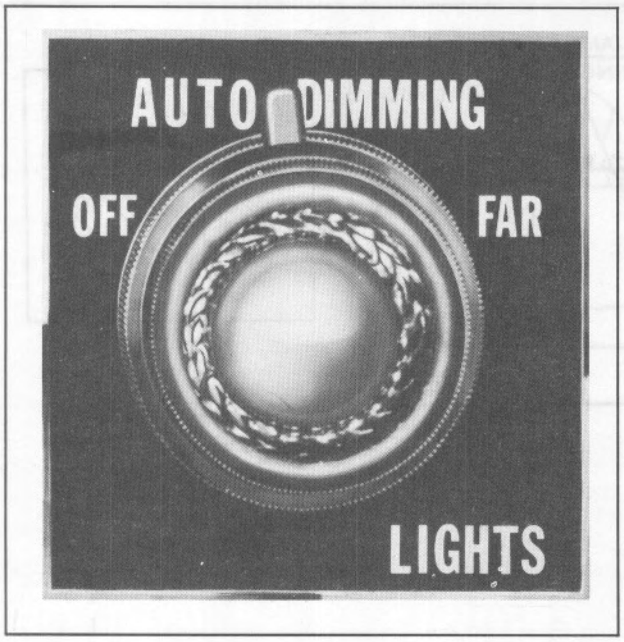


Fig. 15-19 Sensitivity Control Ring

If the road surface is highly reflective (snow, gravel, etc.), the unit may be held on low beam by reflections of its own headlights. If this occurs, slowly rotate driver control counterclockwise until lights return to high beam. This is maximum usable sensitivity for the particular road surface.

Operation—Manual

Rotate driver control pointer to extreme counterclockwise position (off) as indicated on left side of lens. The foot switch will now operate conventionally, switching headlights from high to low beam. High beam position will represent "automatic" position of the foot switch.

Operation—Low Beam

Place foot switch in "low beam" position. Headlights will remain on low beam until foot switch is changed to "automatic" position. Over-riding action is not available since power relay is disconnected from the photo-amplifier.

DIAGNOSIS

25. Dim and Hold Sensitivity Test—On Car

The individual sensitivity controls for Dim and Hold are located in the photo-amplifier and are adjusted and sealed at the factory so they are not accessible in the field. The sensitivity check is only to determine if the driver control can be adjusted to provide the driver at least a minimum acceptable dimming sensitivity (switch to low beam) and at the same time provide an acceptable hold sensitivity (point of return to high beam).

1. Preparation for Test

a. Use Guide-Matic Analyzer, J-21529, with Guide-Matic Analyzer Adapter, J-22622. Since an individual test bulb is no longer incorporated in each photo-amplifier, it is necessary to adapt the present analyzer test bulb assembly (previously designed for use with the Twilight Sentinel) to supply a calibrated light source. A dome-shaped filter is glued into the adapter to reduce light to a level consistent with Guide-Matic sensitivity. The test bulb assembly plugs into the rear of the adapter head. If bulb burns out, replace with a #53 bulb. Make sure filament of bulb is standing fairly straight up so that a minimum of the side of the filament is exposed to the end of the bulb. The end of the bulb should be approximately flush with the end of its rubber sleeve.

b. Install analyzer test bulb assembly into smaller diameter hole in rear of adapter head. Push bulb and rubber sleeve forward until they stop against inner bulkhead wall of adapter head, Fig. 15-20.

c. Install and connect analyzer as shown in Fig. 15-20. (It will be necessary to remove the light baffle boot.) Make sure adapter is seated snugly around lens and bail is snapped tightly into position. Do not disconnect electrical connectors.

d. Wrap photo-amplifier and adapter with black cloth to eliminate any outside light.

e. Rotate analyzer function selector switch to #1 position.

f. Rotate driver control ring pointer counterclockwise to "off" position.

g. Turn on headlights and operate engine at fast idle.

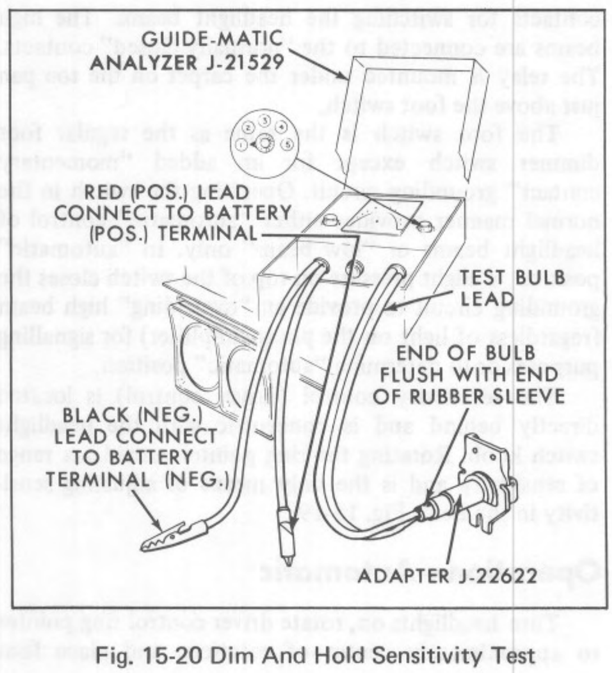


Fig. 15-20 Dim And Hold Sensitivity Test

h. Place foot switch in automatic position. (Headlamps at high beam.)

2. Test Procedure

a. Adjust analyzer voltage control knob until meter reads 7.0 volts.

b. Slowly rotate driver control ring clockwise just to point where headlights switch to low beam.

c. Check accuracy of driver control adjustment by rotating analyzer voltage control knob counterclockwise until headlights switch to high beam. Then slowly rotate analyzer voltage control knob clockwise until headlights switch to low beam. Voltmeter should read between 6.5 and 7.0 volts.

d. If reading does not agree, repeat Steps a, b, and c.

e. Rotate anlayzer voltage control knob counterclockwise to a reading that is 1.0 volt less than reading obtained for switching to low beam in Step c. Wait four seconds. Headlights should not switch to high beam. Rotate analyzer voltage control knob counterclockwise to a reading that is 3 volts less than reading obtained for switching to low beam in Step c. Headlights should switch to high beam within four seconds.

f. If this minimum dim and hold sensitivity can be obtained at any position of the driver control ring, the unit is acceptable for sensitivity and you may proceed to Step g. If dim (switching to low beam) sensitivity cannot be adjusted (Step b), see Fig. 15-21 and check for open circuit to driver control or malfunctioning driver control. If o.k., replace malfunctioning photo-amplifier.

g. Turn off engine, disconnect analyzer, reconnect any wires previously disconnected, remove black cloth from photo-amplifier and reinstall light baffle boot. If it was necessary to remove photo-amplifier from bracket, reinstall and perform vertical aiming adjustment as described in Note 26.

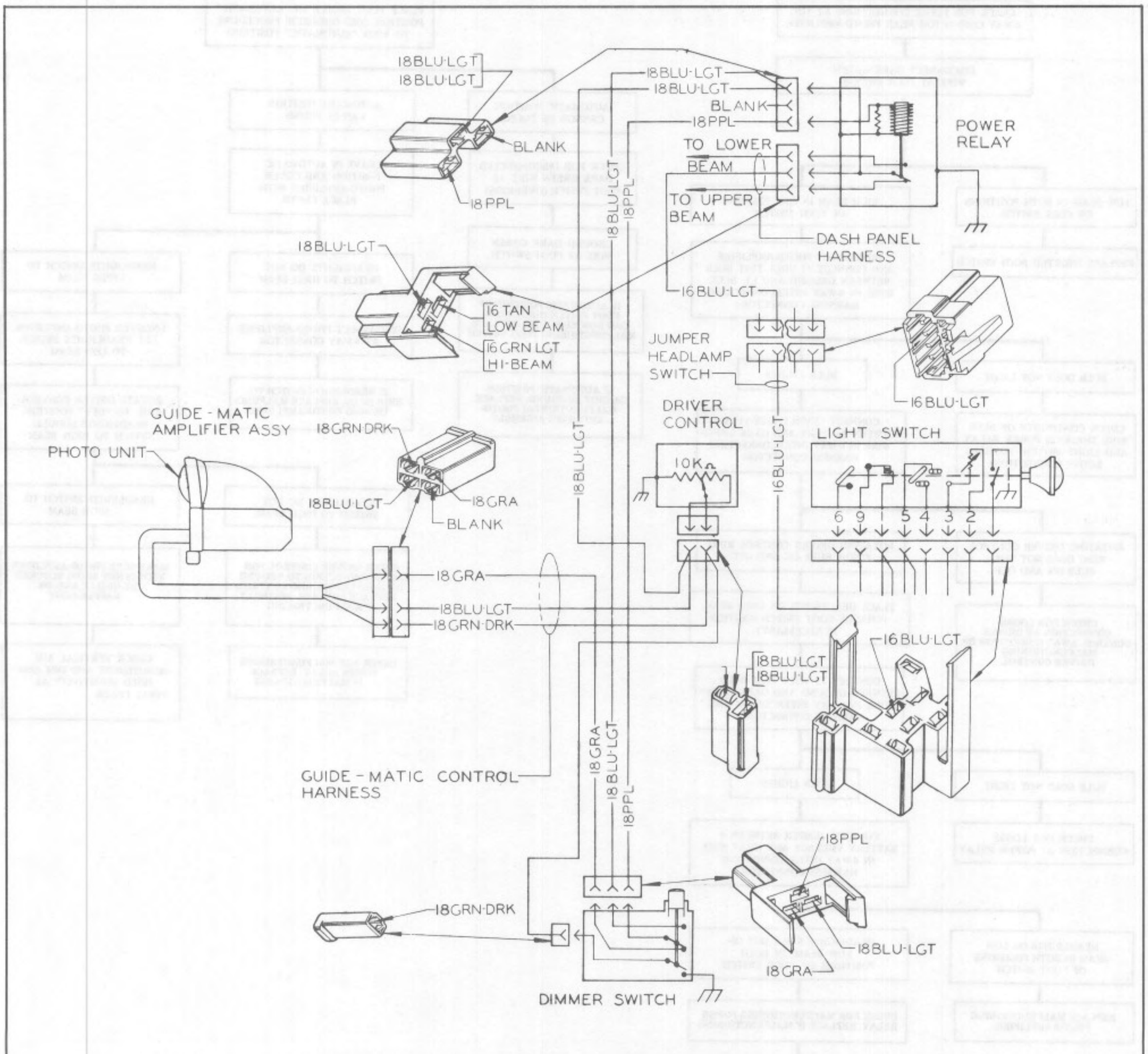
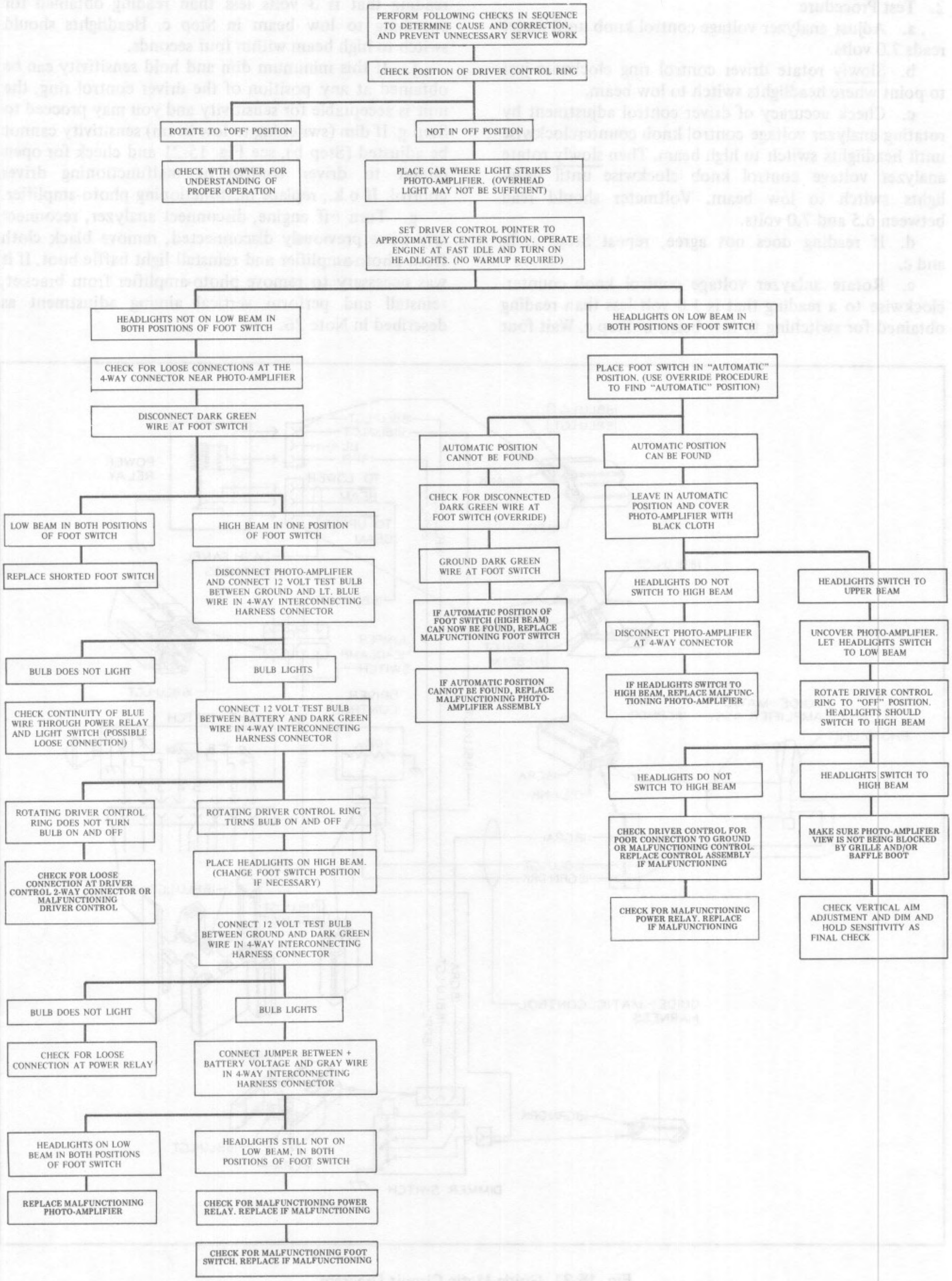


Fig. 15-21 Guide-Matic Circuit Diagram

GUIDE-MATIC DIAGNOSIS CHART



SERVICE INFORMATION

26. Vertical Aiming Adjustment

Accurate vertical aim is essential to proper performance of the Guide-Matic system. If the photo-amplifier is aimed too low, reflected road light from the vehicle's own headlights can cause the Guide-Matic to be slow in returning headlights to high beam or hold them on low beam. The unit must be aimed as low as possible, however, to provide maximum tolerance for car loading, Fig. 15-22.

1. Photo-amplifier vertical aiming should be performed with vehicle unloaded, trunk empty except for spare tire, gas tank at least half full, and tires at correct pressure.

(NOTE: It is not necessary to comply with car load or trunk load specifications if vehicle is equipped with Automatic Level Control.)

2. Locate vehicle on level floor (level within 1/4 inch fore and aft).
3. Rock car sideways and up and down to equalize springs.
4. Raise car hood for access to photo-amplifier.
5. Adjust vertical aiming screw at front of photo-amplifier until bubble is centered in the level assembly.

27. Sensitivity Control Switch

The procedure for removing and installing the Guide-Matic sensitivity control switch is described in Section 12, Note 52.

28. Photo—Amplifier Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect four-way (3 wire) electrical connector near photo-amplifier.

CAUTION: Do not pull on cable sheathing otherwise leads could be damaged.

3. Remove two plastic retainers and carefully peel light baffle boot off leading edge of photo-amplifier mounting bracket.
4. Loosen screw securing photo-amplifier unit to mounting bracket and release retaining spring.
5. Carefully remove photo-amplifier unit from mounting bracket.

b. Installation

1. Connect retaining spring to photo-amplifier unit.
2. Install photo-amplifier unit on mounting bracket and secure with screw.
3. Carefully install light baffle boot around leading edge of photo-amplifier mounting bracket.
4. Connect four-way (3 wire) electrical connector near photo-amplifier.

(NOTE: Make sure connector is firmly installed.)

5. Connect negative battery cable at battery.
6. Adjust vertical aim as described in Note 26.

(NOTE: Vertical aiming adjustment is essential for proper operation.)

29. Power Relay Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect two three-way electrical connectors from power relay unit.
3. Remove two screws that hold power relay unit to toe pan and remove unit.

b. Installation

1. Position power relay unit against toe pan and secure with two screws.
2. Connect two three-way connectors to power relay unit.
3. Connect negative battery cable to battery.

30. Foot Switch

a. Removal

1. Disconnect negative battery cable at battery.
2. Remove left side kick pad.
3. Remove rubber boot from foot switch.
4. Partially raise floor carpet to gain access to foot switch.
5. Disconnect one-way and three-way electrical connectors at foot switch.
6. Remove two screws that hold foot switch to floor pan and remove foot switch.

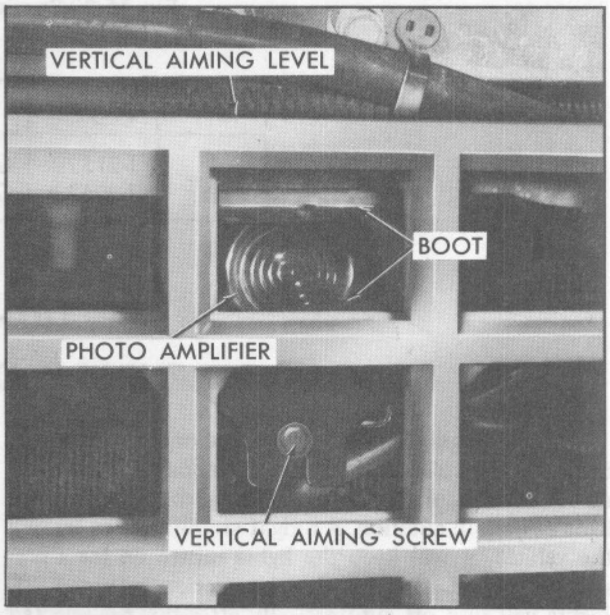


Fig. 15-22 Vertical Aiming Adjustment

b. Installation

1. Install foot switch on floor pan and secure with two attaching screws.
2. Connect one-way and three-way connectors to foot switch.
3. Reposition floor carpet and install left side kick pad.
4. Install rubber boot on foot switch.
5. Connect negative battery cable to battery.

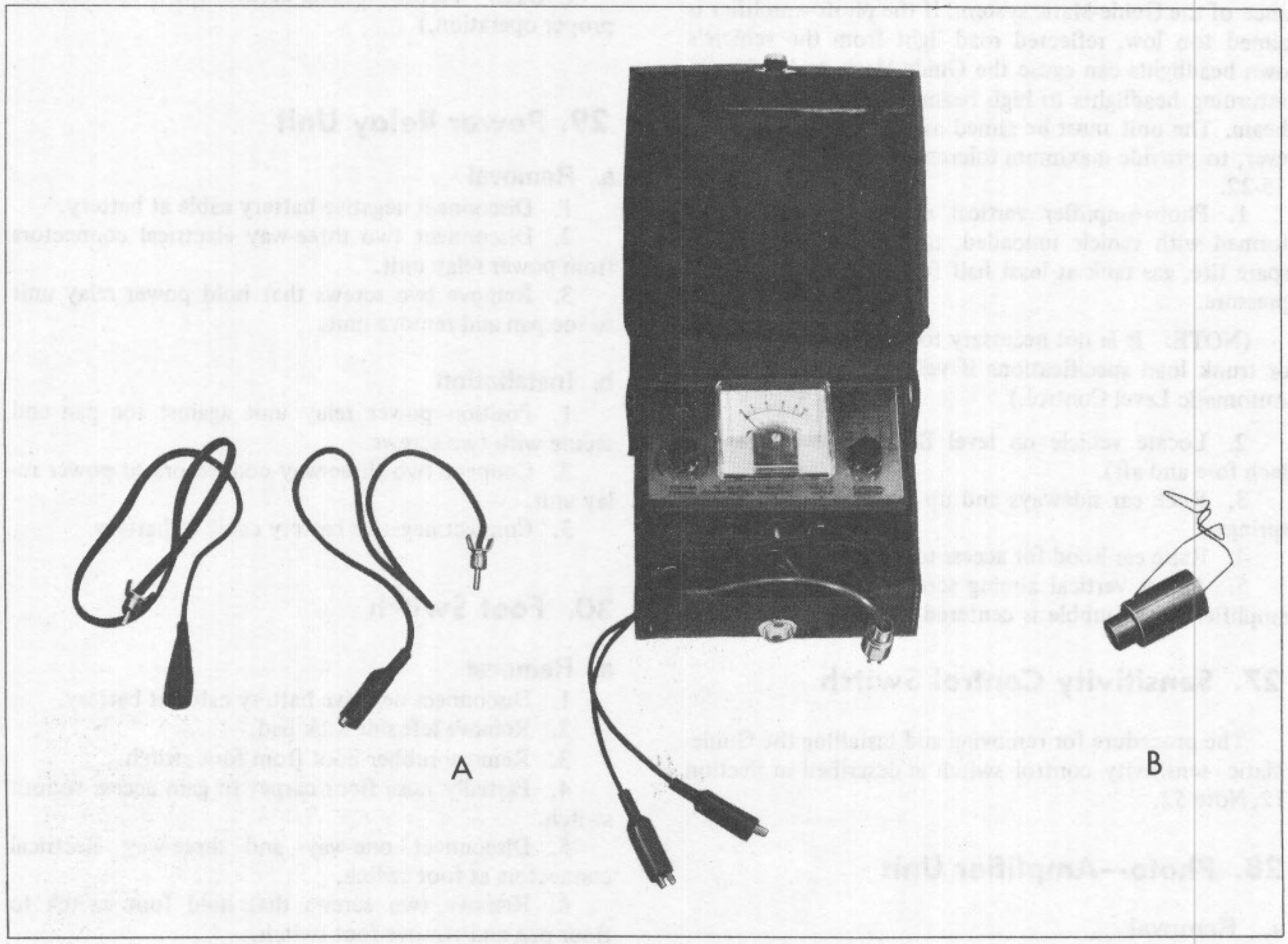


Fig. 15-23 Special Tools—Guide-Matic

Key	Tool No.	Name
A	J-21529	Guide-Matic Analyzer
B	J-22622	Guide-Matic Analyzer Adapter

TWILIGHT SENTINEL
THEORY OF OPERATION

The Twilight Sentinel is an optional convenience item that provides an ambient light-sensitive automatic on-off control of the lights normally controlled by the light switch. In addition, for night visibility when leaving the vehicle, it will keep the lights turned on for a pre-selected period of time after the ignition is turned off. Lights will turn off automatically after this pre-selected time period elapses.

The system consists of a light sensitive photocell assembly, transistorized amplifier, and a time delay control which includes an on-off switch, Fig. 15-24. Connections to the vehicle lights parallel the regular light switch connections therefore requiring the light switch to be turned off to obtain automatic control.

The photocell assembly is mounted with its sensitive surface face up, to obtain an unobstructed view of sky-

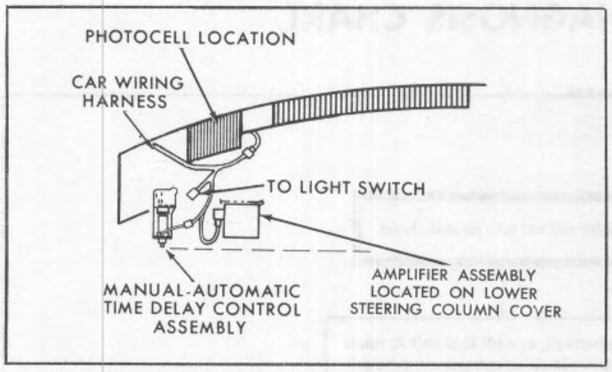


Fig. 15-24 Twilight Sentinel Components

light through the windshield. Mounting location is under the left front speaker grille.

The amplifier unit is mounted on the lower instrument panel brace with a serial number label attached to the side facing the fuse block.

The time delay and on-off switch control is located directly behind and concentric with the regular light switch knob, Fig. 15-25.

The electrical circuit for the Twilight Sentinel is shown in Fig. 15-26.

Operation—Automatic

The Twilight Sentinel system will operate automatically when the following conditions are met: the ignition switch must be on, the headlight switch must be off, and the control ring pointer, Fig. 15-25, must be turned on (any position on the dial counterclockwise from "OFF" position). The system will now turn lights on automatically when daylight reduces to the point at which road illumination becomes necessary. As daylight increases in the morning to the point at which illumination is no longer necessary, it will turn lights off.

A time delay circuit in the amplifier reduces the possibility of undesired switching on or off of lights while passing under viaducts, trees, bright lights, etc. The time delay is nominally 10 to 30 seconds, but in some units it could be as high as 60 seconds. The length of the time delay is set in production and cannot be altered in the field.

The variable time delay control ring adjusts only the time delay period during which the lights will remain on after ignition is turned off. The driver may preselect any desired time delay from a few seconds to a maximum of 1 1/2 to 4 1/2 minutes.

Additional side lighting can be obtained by turning on a cornering light.

Operation—Manual

Should there be an occasion when lights are undesirable such as in tunnels requiring lights off, or if Twilight Sentinel malfunctions, rotate time delay turn-off control ring pointer to "off" position. This disables the Twilight Sentinel by disconnecting the ground circuit. Lights will now operate only by use of the regular light switch.

If lights are desirable during daylight hours, the driver can use either of two methods:

1. Turn on lights by operating regular light switch. The headlight switch is wired in parallel with the Twilight Sentinel. This bypasses the system whether the control ring pointer is on or off. If this method of manual operation is selected, lights will remain on after the ignition is turned off; however, when the driver opens the door to leave the car, a warning buzzer grounded through the door jamb switch reminds the driver to turn off the lights if the ignition switch is turned off.

2. Cover the photocell to block light exposure. This will cause the lights to turn on and still permit the Twilight Sentinel to turn lights off in the normal manner when ignition is turned off. (If cell has been exposed to light, the time delay must elapse before lights will turn on.)

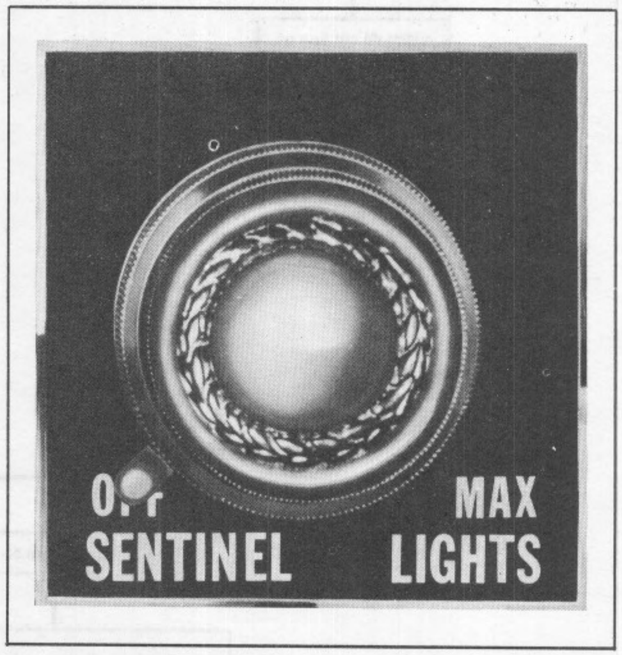


Fig. 15-25 Twilight Sentinel Control Lever

SERVICE INFORMATION

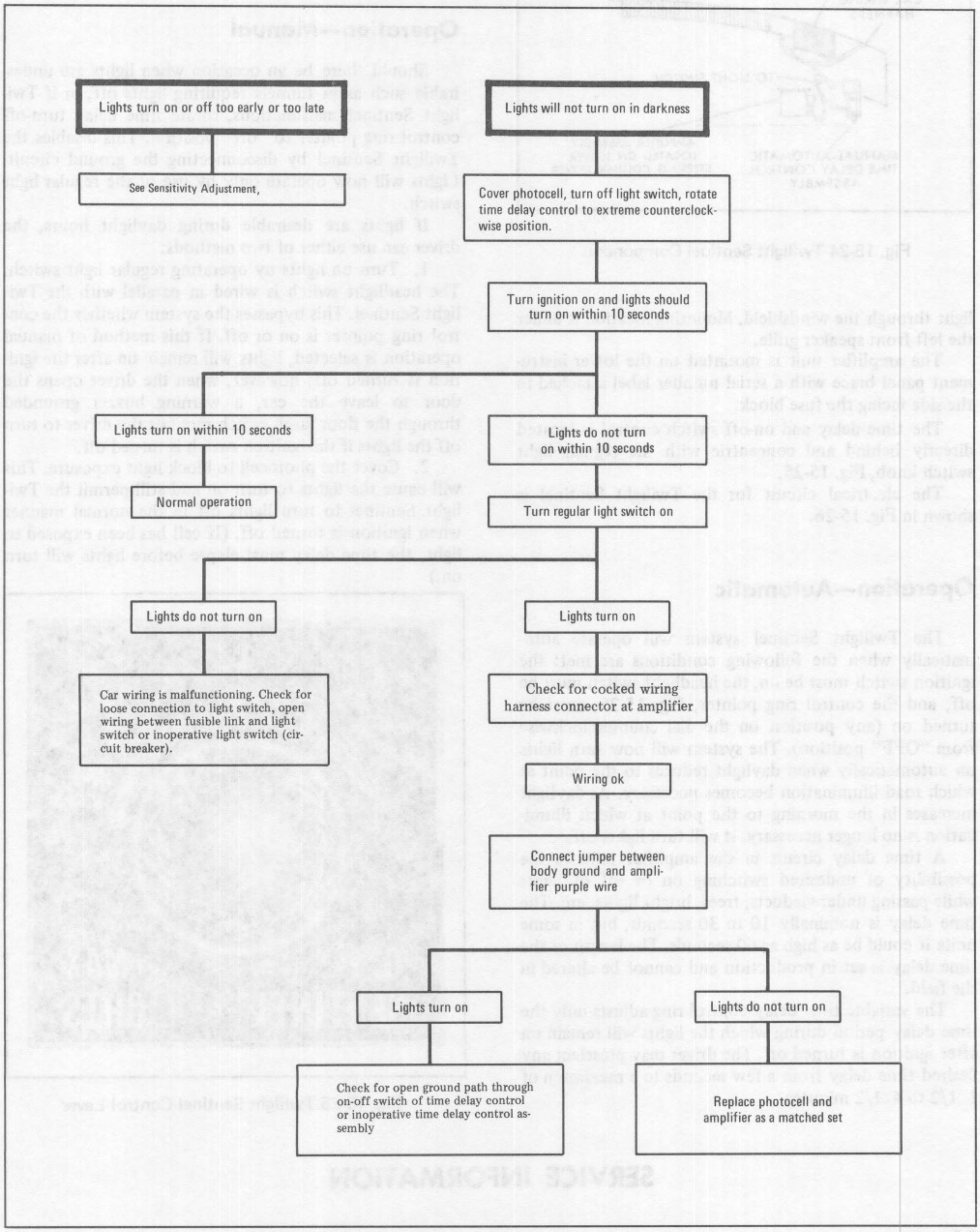
31. Operation and Correction

a. Twilight Sentinel Check List

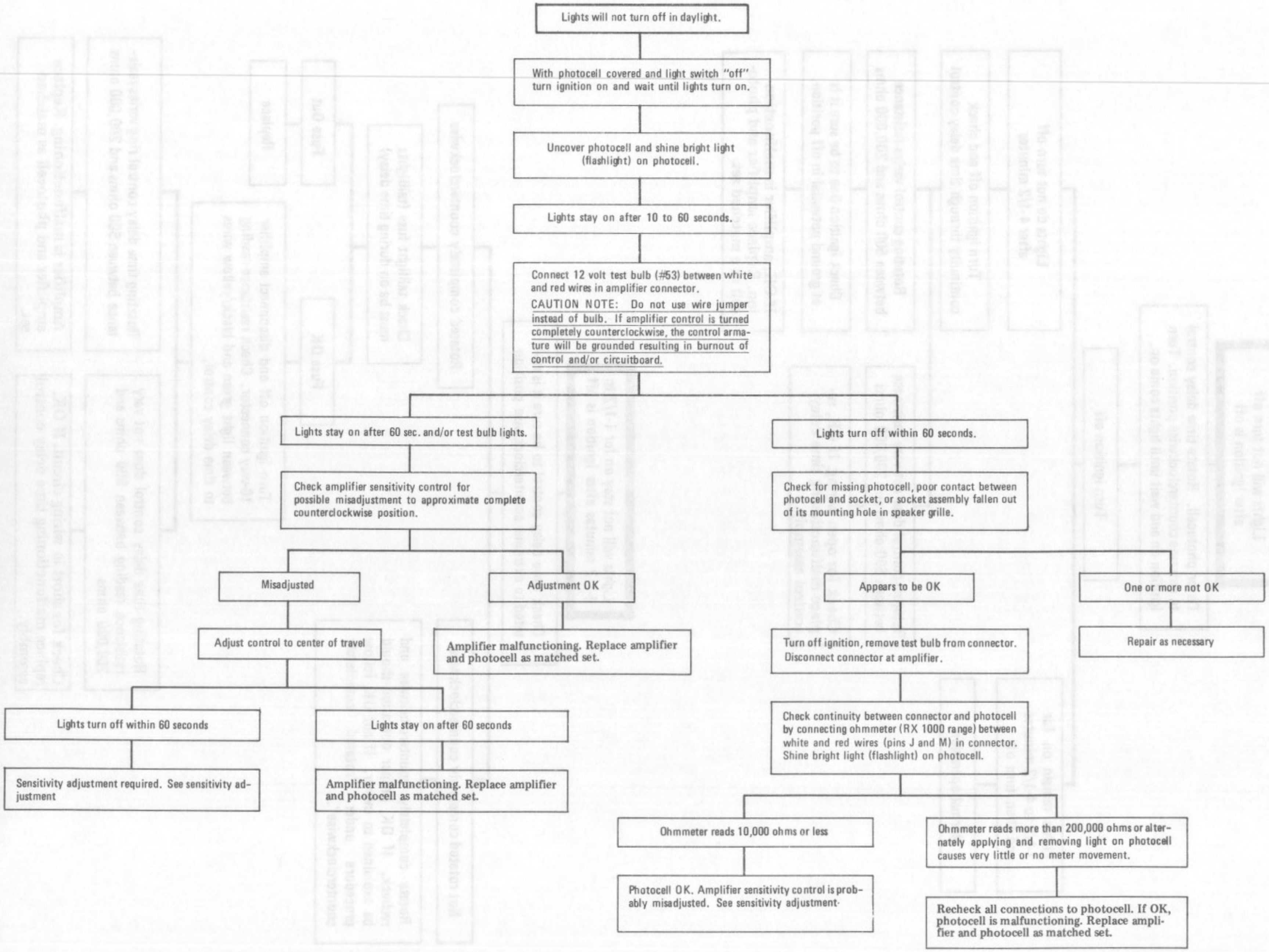
1. Make sure photocell opening located in front LH speaker grille is unobstructed and the headlight switch is in "Off" position.

2. Adjust Twilight Sentinel control ring midway between "Off" and "Max".

TWILIGHT SENTINEL DIAGNOSIS CHART



TWILIGHT SENTINEL DIAGNOSIS CHART (Cont'd.)



TWILIGHT SENTINEL DIAGNOSIS CHART (Cont'd.)

Lights will not turn off after ignition is off

Cover photocell. Rotate time delay control to extreme counterclockwise position. Turn ignition on and wait until lights come on.

Turn ignition off

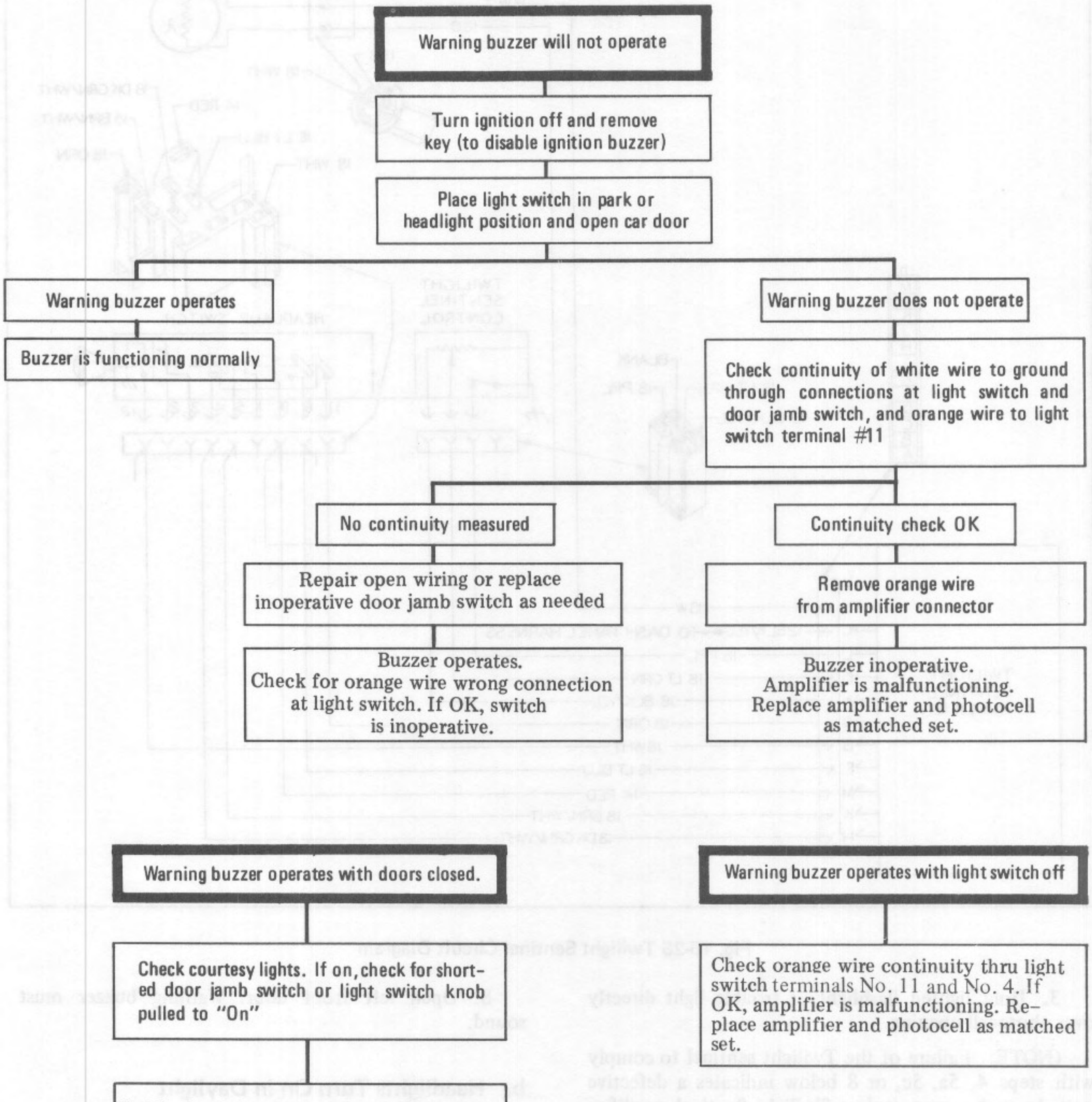
- Lights remain on for 1-1/2 to 4-1/2 minutes and then turn off
  - Normal operation
- Lights do not turn off after 4-1/2 minutes
  - Turn ignition off and check continuity through time delay control
    - Rotating control does not vary resistance between 500 ohms and 200,000 ohms
      - Check for open wiring. If OK, replace malfunctioning time delay control assembly.
    - Rotating control varies resistance between 500 ohms and 200,000 ohms
      - Check ignition line to be sure it is at ground potential in off position.
        - If OK, amplifier is malfunctionion. Replace amplifier and photocell as a matched set.

Lights will not stay on for 1-1/2 to 4-1/2 minutes after ignition is off

Check time delay control to be sure it is rotated to extreme counterclockwise position

- Not rotated completely counterclockwise
  - Rotate completely counterclockwise and recheck. If OK, proper operation should be explained to owner. If not OK, follow procedure under "rotated completely counterclockwise".
- Rotated completely counterclockwise
  - Check taillight fuse (taillights must be on during time delay)
    - Fuse OK
      - Turn ignition off and disconnect amplifier 10-way connector. Check resistance reading between light green and black/yellow wires to time delay control.
        - Rotating time delay control does not vary resistance reading between 500 ohms and 200,000 ohms
          - Check for short in wiring circuit. If OK, replace malfunctioning time delay control assembly.
        - Rotating time delay control ring varies resistance between 500 ohms and 200,000 ohms
          - Amplifier is malfunctioning. Replace amplifier and photocell as matched set.
    - Fuse Out
      - Replace

TWILIGHT SENTINEL DIAGNOSIS CHART (Cont'd.)



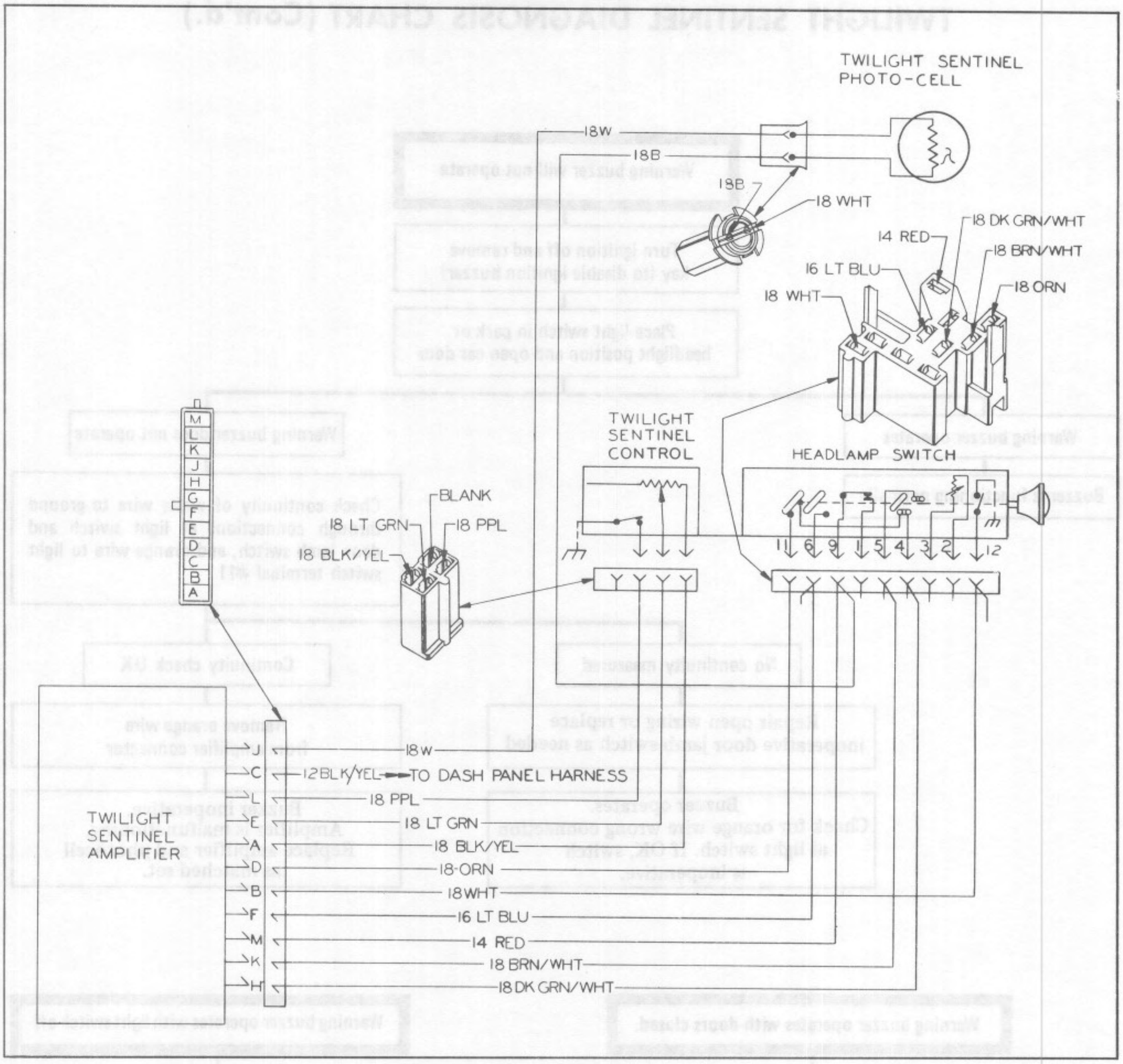


Fig. 15-26 Twilight Sentinel Circuit Diagram

3. Hold lighted flashlight or trouble light directly over photocell opening.

(NOTE: Failure of the Twilight sentinel to comply with steps 4, 5a, 5c, or 8 below indicates a defective unit. In such a case, replace Twilight Sentinel amplifier and photocell unit.)

4. Turn ignition key to "On" position. Headlights and taillights must remain off.

5. Remove flashlight or trouble light and cover photocell opening with a heavy dark cloth:

a. Headlights and taillights must turn "On" within one minute.

b. Turn ignition switch to "Off" position.

c. Headlights and taillights must turn "Off" (within 3 minutes normally).

6. Remove cloth cover from photocell opening.

7. Pull headlight switch out to "On" position.

8. Open left front door. Warning buzzer must sound.

b. Headlights Turn On in Daylight When Ignition is Turned On

Some cars equipped with Twilight Sentinel may experience a condition where the headlights turn on in daylight when the ignition is turned on.

Whenever this happens, the most likely cause is a "disconnect" or "open" in the photocell leads, or the photocell itself has dropped from its mounting hole in the radio speaker grille and is laying somewhere in darkness under the instrument panel top cover (thus the lights go on, even in daytime).

A connected photocell will show resistance anywhere from 3,000 to 50,000 ohms (3 to 50 on the Rx1K scale) depending on the light level in the shop. If the

resistance reading varies when the photocell is covered, connections in the lead wires are okay.

An open circuit will be indicated by a maximum reading (usually ∞ infinity reading on the meter). If an open is indicated, check to see if the photocell wires are making contact in the photocell socket.

32. Sensitivity Adjustment

If a photocell or amplifier is malfunctioning, both must be replaced as a matched set since no provision is made for adjusting a mismatched set. However, if the owner is dissatisfied with evening turn-on time or morning turn-off time, a recommended procedure to advance or retard turn-on time by 15 minutes is given below:

a. Headlights Turn On Too Late In Evening (Or Off Too Early In Morning)

1. Leave ignition and lights turned off.
2. Cover photocell so no light strikes it.
3. Take resistance reading between J and L terminals in amplifier connector.
4. See Fig. 15-27. Adjust control screw clockwise until resistance reads one-half of value read in Step 3.
5. If amplifier has been previously adjusted set resistance value to 4100-4500 ohms.

b. Headlights Turn On Too Early In Evening (Or Off Too Late In Morning)

Follow same procedure as described in Steps 1 through 5 above except under Step 4 adjust control screw counterclockwise until resistance reads one and one-half times value read in Step 3.

33. Control Switch

The procedure for removing and installing the Twilight Sentinel control switch is described in Section 12, Note 52.

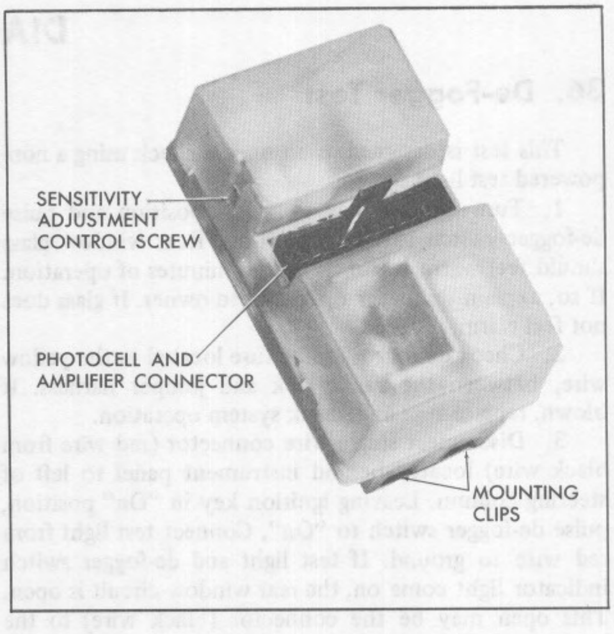


Fig. 15-27 Sensitivity Adjustment Control Screw

34. Photocell Unit

The procedure for removing and installing the Twilight Sentinel photocell unit is described in Section 12, Note 38.

35. Amplifier Unit

The procedure for removing and installing the Twilight Sentinel amplifier unit is described in Section 12, Note 39.

REAR WINDOW DE-FOGGER THEORY OF OPERATION

The rear window De-Fogger option is available in tinted glass only, as a factory installed accessory, on all body styles, except the Fleetwood Seventy-Five and Commercial Chassis.

The De-Fogger on Fleetwood Seventy-Five styles is integral with the rear air conditioning unit, which is standard equipment. The De-Fogger operates whenever the rear air conditioner is operating in the heater mode. For additional information on this unit refer to Section 1 of this manual.

A rear window De-Fogger is not offered for the Commercial Chassis.

The rear window De-Fogger is an electrically heated back light. It does not use a blower motor, hoses or ductwork. The circuit diagram is illustrated in Fig. 15-29.

The switch for controlling the De-Fogger is located in the accessory switch panel, to the right of the steering column. Momentarily moving the spring loaded switch to the "ON" position energizes a time-delay relay, located on the upper steering column support. The time-delay relay is fed current from the fuse block through a 25 amp. in-line fuse. Current then flows from the relay to the heated back light. The heated back light consists of silver ceramic electrically conductive horizontal grid lines. When the grid lines are subjected to current flow, they heat the glass and remove fog from the glass surface.

A green indicator light in the switch is illuminated whenever the De-Fogger is operating. When the switch is pulsed on, the relay allows current to flow for approximately ten minutes, then shuts off. Additional periods of heating operation can be obtained each time the switch is pulsed on. Pulsing the switch "ON" while the De-Fogger is in operation will not extend the heating period beyond the normal delay cycle. The De-Fogger must shut itself off before it can be re-energized. The De-Fogger can be manually shut off at anytime during its time delay cycle; by momentarily moving the control switch to the "OFF" position. Turning off the ignition switch also turns off the De-Fogger.

DIAGNOSIS

36. De-Fogger Test

This test is designed as an on car check using a non-powered test light.

1. Turn ignition key to "ON" position and pulse de-fogger switch to "On" position. Rear window glass should feel warm to touch after 3 minutes of operation. If so, explain de-fogger operation to owner. If glass does not feel warm, proceed.

2. Check de-fogger in line fuse located in the yellow wire, between the fuse block and jumper harness. If blown, replace fuse and check system operation.

3. Disconnect single wire connector (red wire from black wire) located behind instrument panel to left of steering column. Leaving ignition key in "On" position, pulse de-fogger switch to "On". Connect test light from red wire to ground. If test light and de-fogger switch indicator light come on, the rear window circuit is open. This open may be the connector (black wire) to the heating element lead, the heating element or the ground wire attachment. Reconnect wiring connector. If light does not light, proceed with check.

4. Remove lower steering column cover to gain access to timer relay located on the left side of the column upper support. Remove wiring connector from relay. With ignition key in "On" position, connect test light between the yellow wire in the connector and ground. Test light should light. If test light does not light, the 3-way connector or the switch is faulty. If light comes on, proceed with check.

5. Reconnect wiring connector to timer relay. Leaving ignition key in "On" position, connect test light between "L" terminal on relay (red wire) and ground. Pulse de-fogger switch to "Off" to cancel time delay cycle of relay. Pulse de-fogger switch to "On" position, starting new time delay cycle, and release. Test light should light. If checks did not perform as outlined in this step,replace timer relay and check system operation.

6. If all previous checks do not locate cause of inoperative condition, test de-fogger switch using procedure outlined in Note 37 of this section.

37. De-Fogger Switch Test

1. Remove accessory switch panel as outlined in Section 12, Note 61a.

2. Disconnect switch wiring connector from De-Fogger harness connector, bulb with socket from switch and remove accessory panel with switch attached.

3. Connect self-powered test light across yellow and light green wires. Test light should now be off. Pulsing De-Fogger switch to "ON" position should turn test light on. Remove test light lead from yellow wire and connect it to brown lead, leaving other lead on light green wire. Pulsing switch to "OFF" position should make test light come on.

4. Visually check switch light bulb. If filament of light bulb is intact, reinstall light bulb and socket into switch housing. If light bult does not light or filament is broken, the bulb should be replaced.

5. Install accessory switch panel with De-Fogger switch into instrument panel as outlined in Section 12, Note 61b.

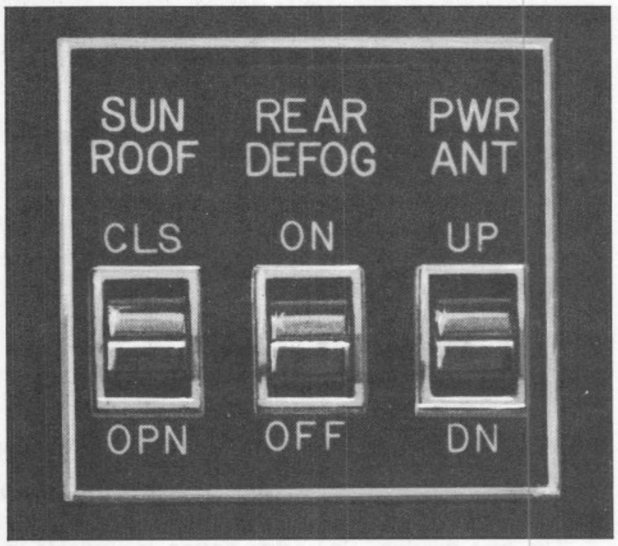


Fig. 15-28 Accessory Switch Panel

SERVICE INFORMATION

38. De-Fogger Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Section 12, Note 61. All other service information pertaining to the rear window De-Fogger is covered in the body manual.

39. De-Fogger Relay Removal and Installation

a. Removal

1. Remove lower steering column cover as outlined in Section 12, Note 31a.

2. Disconnect electrical wiring connector from relay.

3. Remove two screws securing relay to upper steering column support and remove relay.

b. Installation

1. Position relay to upper steering column support and secure with two screws.

2. Connect electrical wiring connector to relay.

3. Install steering column lower cover as outlined in Section 12, Note 31b.

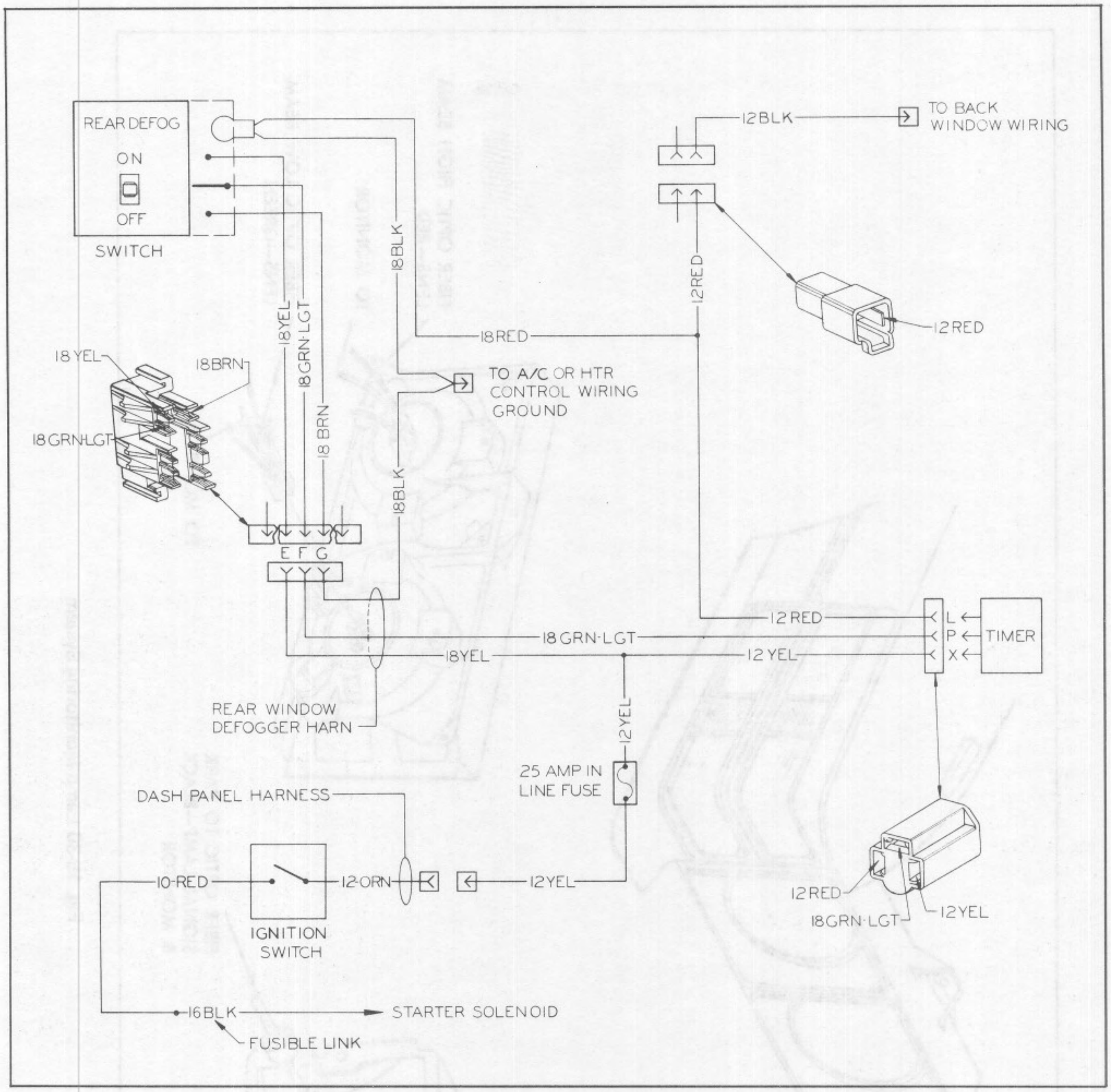


Fig. 15-29 Rear De-Fogger Circuit Diagram

LAMP MONITOR SYSTEM

THEORY OF OPERATION

The Lamp Monitor system is an optional accessory on all Cadillac cars. It is provided as standard equipment on later 1974 model cars. It allows the driver to visually check the operation of the exterior lamps without leaving the vehicle. This is accomplished through the use of light conductors. The conductors are used to transfer light from the individual exterior lamp to its respective monitor Fig. 15-30. The system does not draw power in order to operate, nor does it have any moving parts.

Three individual lamp monitors are used. One monitor is mounted on top of each front fender, and one at the center of the headliner, immediately above the rear window. On convertibles, the rear monitor is mounted to the back of the rear seat.

The fender mounted monitors indicate the light from the inner and outer headlamps and the park and signal lamps.

Each lamp monitored, except headlamps, has a pickup mounted in the housing; the headlamp pickup is located in the connector on the wiring harness and picks up the light from the sealed beam unit exhaust nipple.

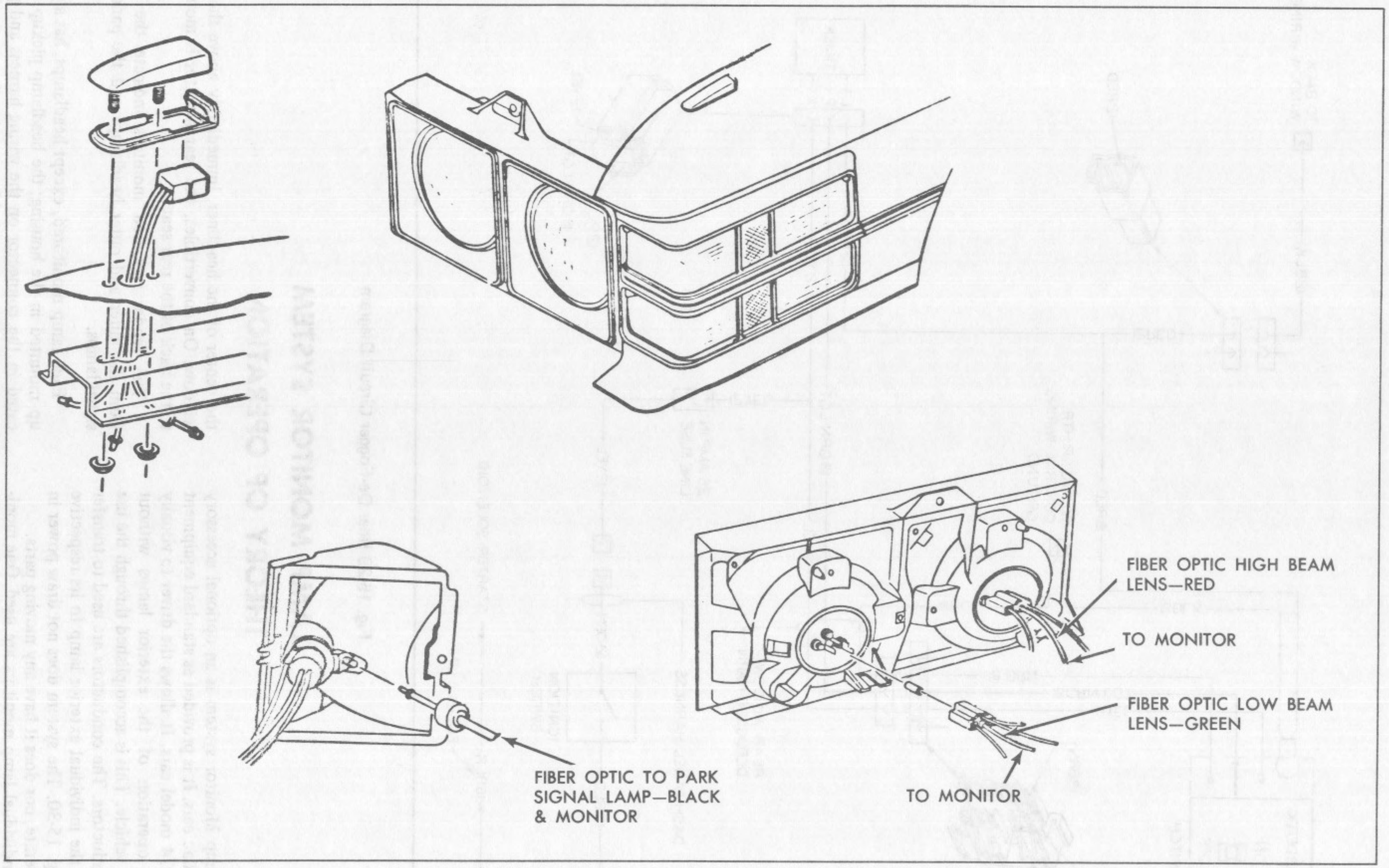


Fig. 15-30 Lamp Monitoring System

The rear monitor indicates each tail lamp on the respective side of the vehicle.

Refer to body service manual for servicing rear lamp monitor.

LAMP MONITOR SYSTEM

DIAGNOSIS

40. Monitor Inoperative

1. Check bulb in lamp connected to inoperative monitor.
2. If bulb is burned out, replace bulb. If lamp operates normally, proceed with further checks.
3. Check for proper installation of conductors to sealed beam or lamp housing as required. If correct, proceed to Step 4.
4. Check conductor harness mounting to lamp monitors for proper attachment.
5. Check conductor harness routing for pinched or severely bent condition.
6. If none of the above checks reveals the inoperative condition, the conductor light fibers have probably been damaged. Replace conductors as required.

41. Front Monitor Harness

a. Removal

1. Open Hood.
2. Disconnect conductor harness from front lamps.
3. Reach under fender and remove two nuts from read-out mounting studs and raise read-out from fender.
4. Detach monitor connector from read-out and remove read-out.
5. Remove read-out connector with conductor harness by pulling out through hole in top of fender.

b. Installation

1. Install lamp end of conductors down through hole in top of fender.
2. Route harness and install conductor ends into respective lamps.
3. Install monitor connector on read-out and position read-out on front fender.
4. Reach under fender and install two nuts on read-out mounting studs to secure read-out to fender.
5. Check operation of read-out. If satisfactory, close hood. If not, check installation and routing.

42. Front Monitor Read-out Removal and Installation

a. Removal

1. Open hood.
2. Reach under fender and remove two nuts from read-out mounting studs and raise read-out from fender.
3. Detach monitor connector from read-out and remove read-out.

b. Installation

1. Install monitor connector on read-out and position read-out on front fender.
2. Reach under fender and install two nuts on read-out mounting studs to secure read-out to fender.
3. Check operation of read-out. If satisfactory, close hood. If not, recheck installation.

CONTROLLED CYCLE WINDSHIELD WIPER AND WASHER SYSTEM

Controlled Cycle Wiper System Mechanical Features

The controlled cycle windshield wiper and washer system consists of a wiper unit which contains a 12-volt motor, a gear box section, a relay control, a pulse timing control, and a washer unit.

The wiper and washer assembly is controlled by a switch (driver control) located on the instrument panel pad to the left of the left hand air conditioning outlet. The wipers can be operated at the usual three different speeds plus a new delay position. The washers are activated by depressing the washer button, integral with the switch. When the washer button is depressed, the wipers operate at low speed, even when in the delay mode. The washer delivers washer fluid to the windshield for approximately six complete wipe sweeps after the button is depressed. After washer fluid delivery stops, the blades continue for two additional wipes to dry the glass, and then stop automatically (unless control switch is "ON").

In the "DELAY" mode, the wipers will stop at a "rest" position at the bottom of the windshield after a delay wipe or after the wash cycle.

Controlled Cycle Wiper System Electrical Operation (Fig. 15-31)

Low Speed - Moving the control lever to the "LO" speed position connects the relay control, the shunt field, and the pulse relay directly to ground. This provides the following circuit:

Current feed to the 25 AMP windshield wiper fuse in the fuse panel comes from the accessory terminal on the ignition switch. Current flows through the yellow wire to terminal number 2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch. Current also flows through the relay coil and back through the red wire to terminal number 1, and through the light blue wire and the switch to ground. Current through the relay coil causes the relay switch to

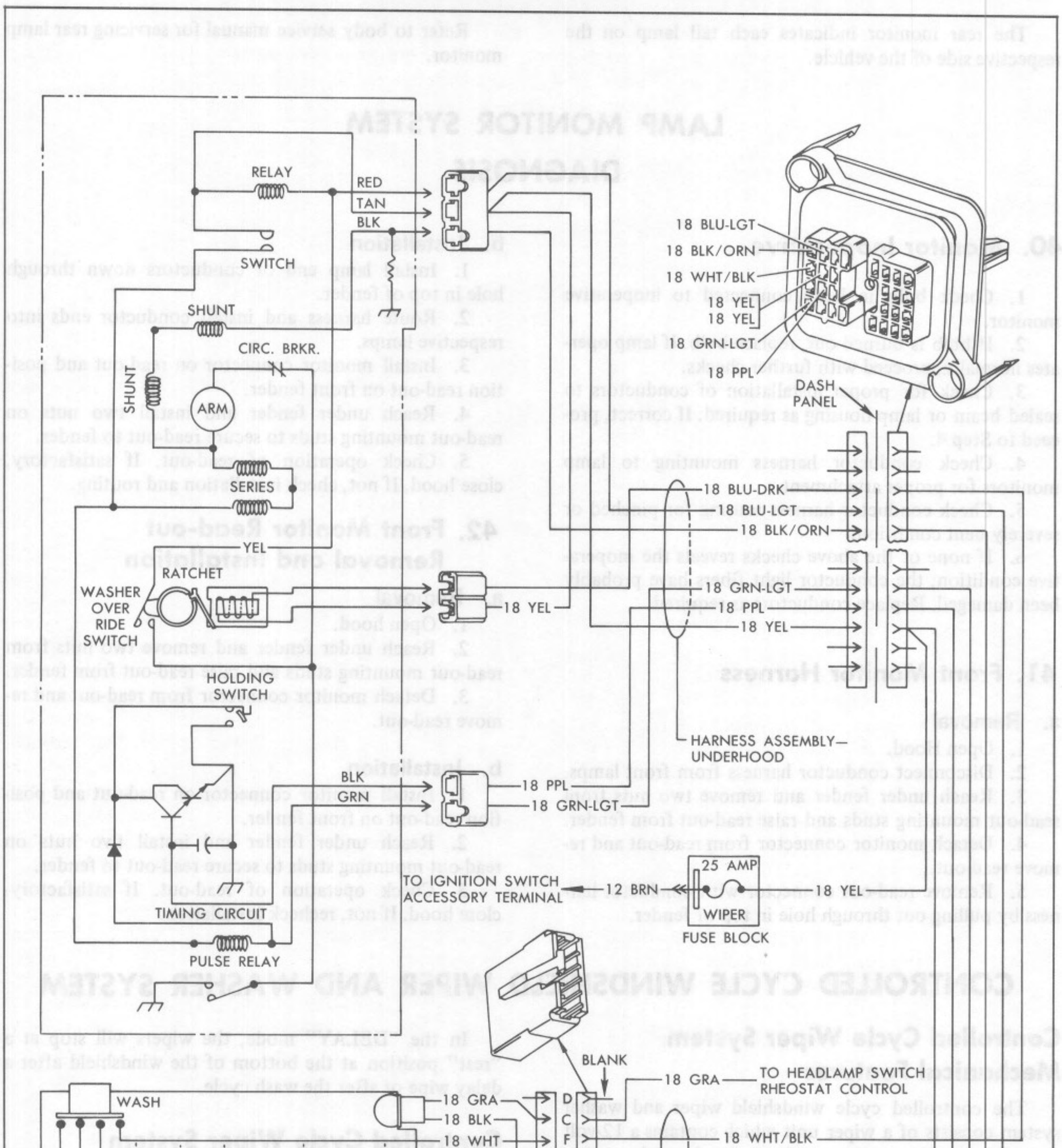


Fig. 15-31 Windshield Wiper Electrical Circuit

close to allow current to flow to the motor. After the current passes through the relay switch, it flows through the orange wire, through the pulse relay coil, and through the green wire to terminal six back to ground through the switch. Current through the pulse relay closes the pulse relay switch to allow current to flow through the series field, where it divides; part flowing through the armature, and through the circuit breaker and black wire to ground, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with double orange tracer wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal number 3 at this time because of the lower resistance of the control switch ground circuit.

Medium Speed - Moving the control switch to the "MEDIUM" speed position connects a 13 ohm resistor, located in the control switch, in parallel with the 20 ohm resistor connected between the shunt field circuit and ground. The two resistors connected in parallel provide slightly less than 8 ohms resistance in the shunt field, thus allowing less current to flow in the shunt field than was possible in "LO" speed. This permits correspondingly more current to flow through the armature, resulting in medium speed.

High Speed - Moving the control switch to the "HIGH" speed position eliminates the path from the shunt field to ground in the control switch, leaving only the 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at medium or low speeds, which results in high speed operation.

Delay - Moving the switch to the delay position grounds the relay coil and the shunt field through the control switch as in low speed operation. With the switch in the minimum delay position, the wipers operate identically to low speed operation. However, as the switch is moved to the right, the wipe speed remains the same, but a pause is introduced between wipe cycles. At the maximum delay position, a pause of approximately 10 seconds occurs between each wipe cycle. This is accomplished electrically by the use of a transistor and capacitor in the timing circuit and the variable resistor in the driver control switch. In the delay position, the pulse relay coil must be grounded through the timing circuit, as the ground in the driver control switch is not available as in the case in normal operation. When the transistor "turns on", allowing current to flow to ground through the black wire, the pulse relay switch closes and current can flow through the armature and circuit breaker to ground, causing the motor to operate at low speed. When the motor starts, the holding switch closes and the transistor turns off. At the completion of one wipe, the holding switch opens and the ground path for the pulse relay is broken, causing the pulse relay switch to open and the motor stops. The length of the period of time before the transistor turns on again depends on the value of the variable resistor, which in turn depends on the setting of the driver control. Thus, the delay period can be varied from 0 to 10 seconds with the driver control.

Washer Circuit (Fig. 15-31)

Depressing the washer button on the control switch puts the motor in low speed operation but does not physically move the control lever to the low speed position. When the button is depressed, the relay coil and washer coil are momentarily grounded through the control switch. The pulse relay is also grounded through the control switch. This causes the motor to operate, and the washer ratchet rotates allowing the washer override switch to close. When the washer button is released, the ground for the relay coil through the control switch is lost, but the washer override switch allows the current to flow to ground through the black wire and pulse relay switch. Washer fluid is delivered for approximately six complete sweeps after the button is depressed. Two more wipes are made before the washer ratchet wheel forces the washer override switch to open. This eliminates the path to ground for the wiper relay and causes the contact points to motor and the wipers automatically shut off.

If the washer button is depressed while the switch is in the delay position, the normal wash cycle will take place and then the system will return to delay operation.

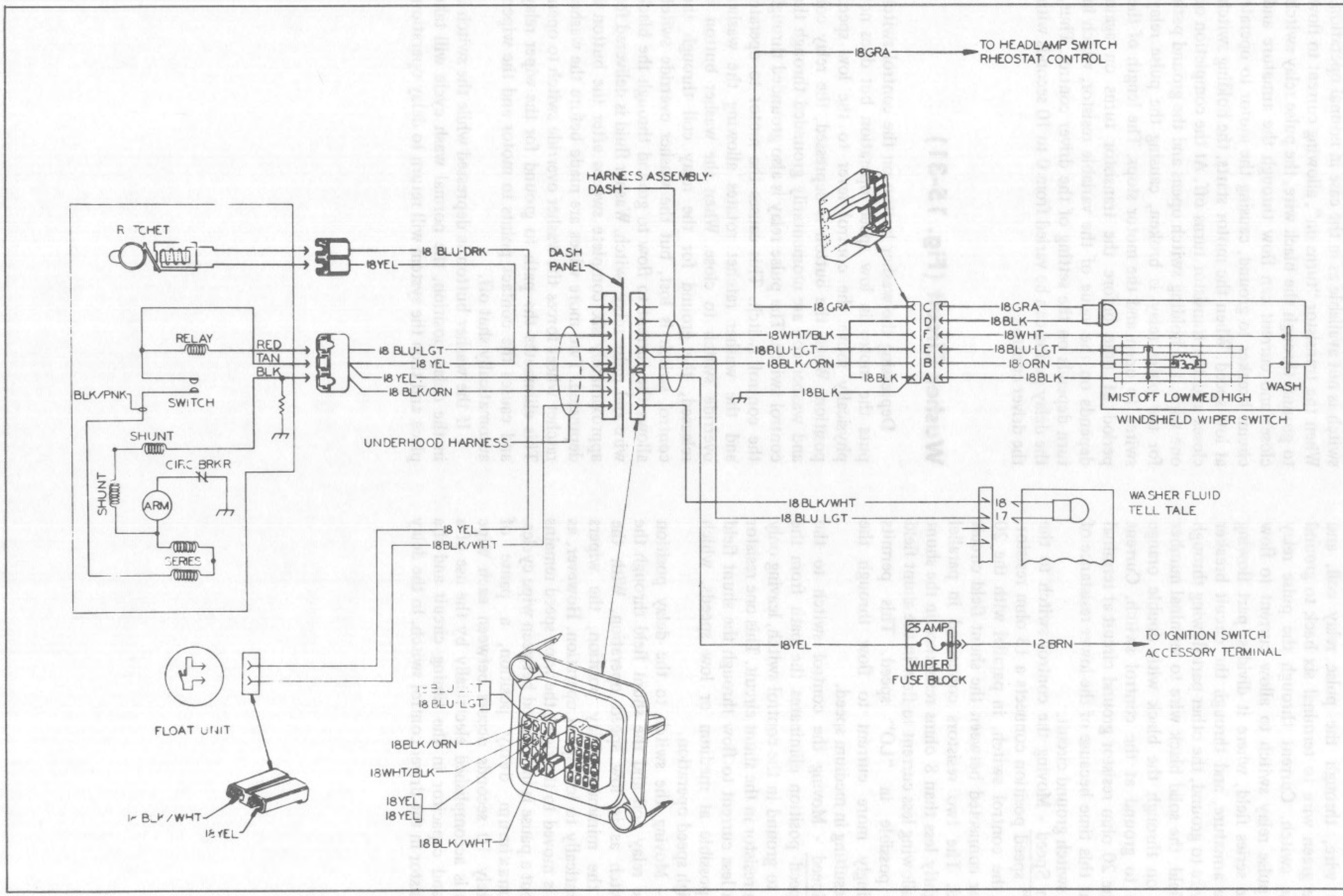


Fig. 15-32 Washer Fluid Indicator Circuit Diagram

WASHER FLUID LOW LEVEL INDICATOR

GENERAL DESCRIPTION

A washer fluid low level indicator light is provided on cars equipped with the Lamp Monitor option. It is provided as standard equipment on later 1974 model cars. The light is located on the left side of the tell tale housing. It is labeled "WASHER FLUID" and it glows amber when the fluid level in the windshield washer bottle drops below approximately 1/3 full.

Engaging the wipers allows a small amount of current to flow from the wiper motor terminal through a #18 yellow wire to the washer bottle float unit, Fig. 15-32. When the fluid level in the washer bottle is low, the float drops, allowing the circular magnet to separate from the cap assembly, Fig. 15-33. This permits the contact points within the cap to close, bypassing the resistor that is in parallel with the contact points, and causing current to flow to the indicator light.

The indicator system operates in conjunction with the windshield wiper motor. A low fluid level condition will not be indicated to the driver unless the windshield wipers are running.

The complete float and cap unit must be replaced if inoperative.

CAUTION: Use care when handling the float assembly, as the switch is sealed air-tight in glass and can be broken if subjected to a hard impact.

Refer to body service manual for servicing windshield wiper and washer system.

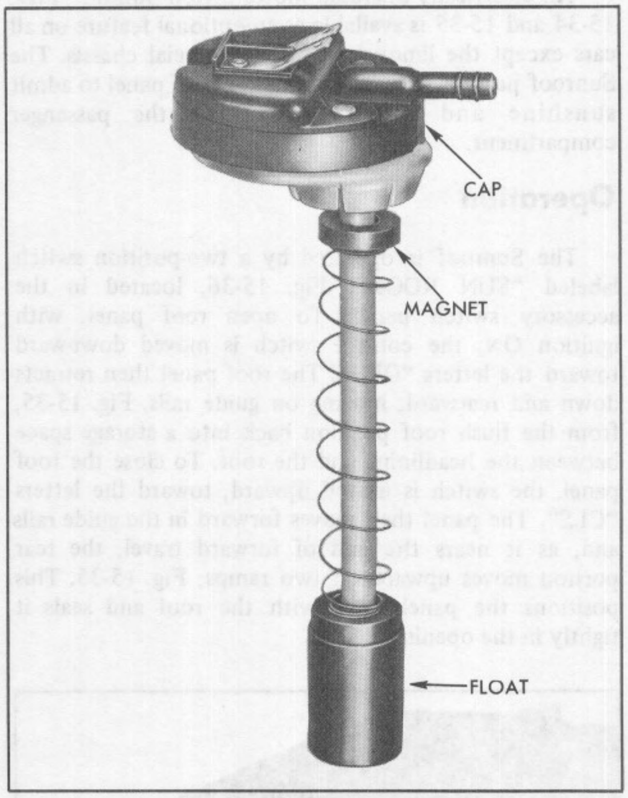


Fig. 15-33 Float Unit

43. Indicator Inoperative

1. Turn windshield wipers on. Indicator will not operate unless wipers are running.
2. Open hood. Using a jumper wire, connect the two terminals to by-pass float, bulb should light. If it does not, replace bulb..
3. Remove float and cap assembly from washer bottle. Float should move to bottom of stem and magnet should separate from cap; if not, replace float and cap assembly.
4. Examine cap. If damage is evidenced, replace float and cap assembly.
5. Check electrical connections at cap.

SUNROOF

THEORY OF OPERATION

An electrically-operated motor-driven Sunroof, Figs. 15-34 and 15-35 is available as an optional feature on all cars except the limousine and commercial chassis. The Sunroof permits opening of a sliding roof panel to admit sunshine and outside air into the passenger compartment.

Operation

The Sunroof is operated by a two-position switch labeled "SUN ROOF", Fig. 15-36, located in the accessory switch panel. To open roof panel, with ignition ON, the control switch is moved downward toward the letters "OPN". The roof panel then retracts down and rearward, moving on guide rails, Fig. 15-35, from the flush roof position back into a storage space between the headlining and the roof. To close the roof panel, the switch is moved upward, toward the letters "CLS". The panel then moves forward in the guide rails and, as it nears the end of forward travel, the rear portion moves upward on two ramps, Fig. 15-35. This positions the panel flush with the roof and seals it tightly in the opening.

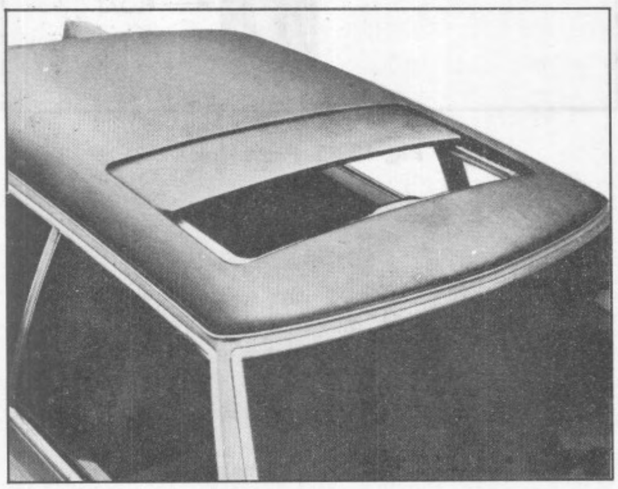


Fig. 15-34 Sunroof Partially Opened

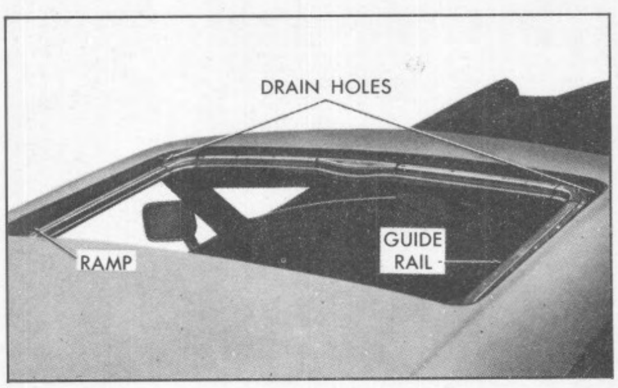


Fig. 15-35 Sunroof Fully Opened

The Sunroof can be left partially open by releasing the control switch at any position in either direction of its travel.

Manual Operation

The Sunroof can be closed manually in the event it should fail to close when the control switch is moved to the "CLS" position. To do this, remove the small round plug located in the center of the headlining near the front edge of the roof opening to gain access to the winding gear. Remove the plug by grasping with fingers and pulling outward, Fig. 15-37. Remove the screw (visible when plug is removed) using hex end of crank handle provided in glove box.

(NOTE: Observe the number and type of washers removed with the screw. The screw and washers provide adjustment for the auxiliary drive clutch.)

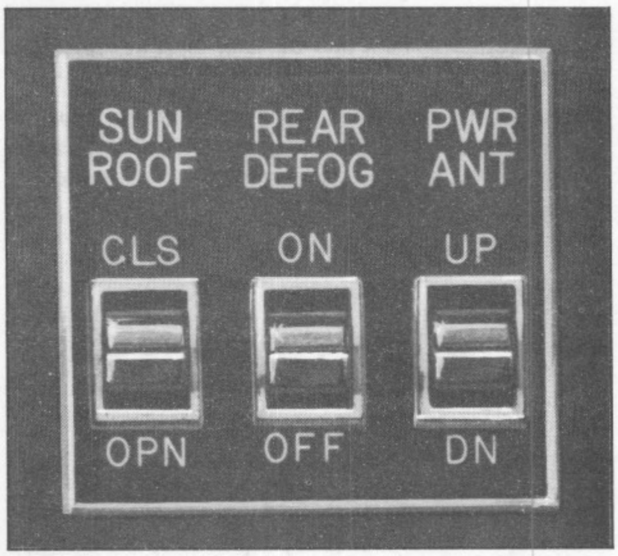


Fig. 15-36 Accessory Switch Panel

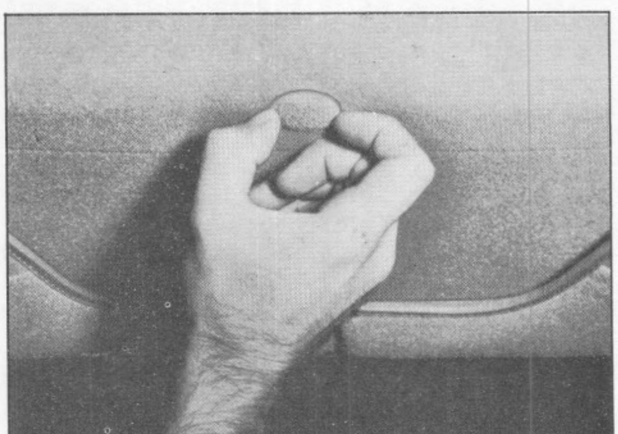


Fig. 15-37 Removing Winding Gear Access Plug

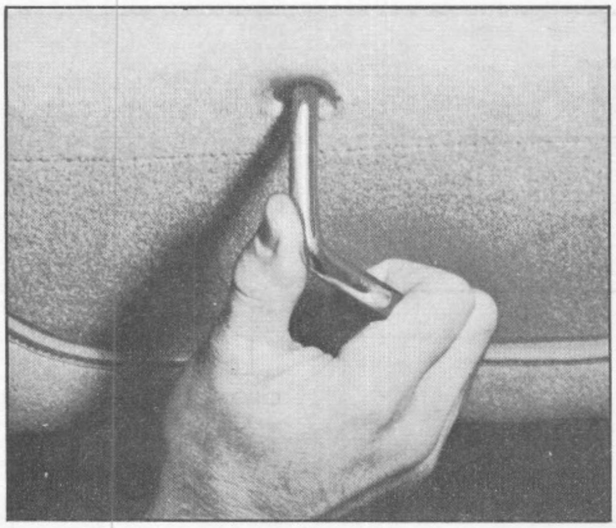


Fig. 15-38 Closing Sunroof with Crank Handle

The threaded end of crank handle is screwed into the winding gear, Fig. 15-38. Turn crank handle clockwise to close the roof. Remove the crank handle, install the screw with washers in their proper order, and tighten the screw securely, then replace the round plug.

(NOTE: The crank handle can be used only to close the roof.)

Design and Construction Features

The Sunroof is actuated by a two-way electric motor mounted near the center of the windshield header area, Fig. 15-39. The motor drives an auxiliary unit with a gear on the output shaft. This gear, in turn, drives two flexible gear cables that are attached to the roof panel and control its movement, Fig. 15-40.

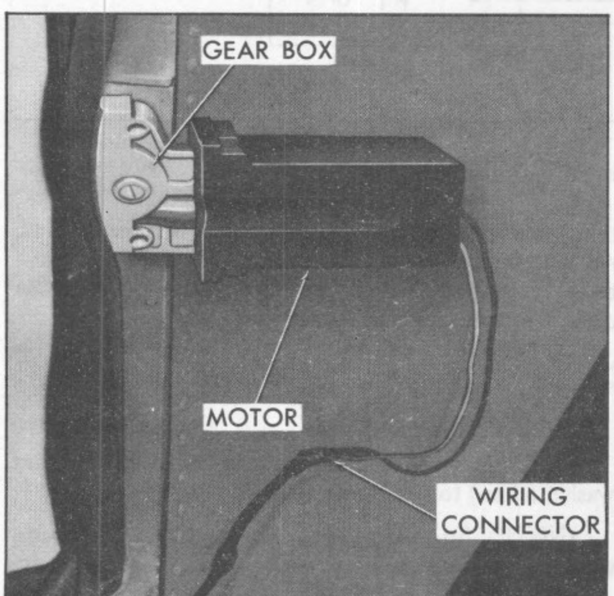


Fig. 15-39 Motor And Drive Unit Location

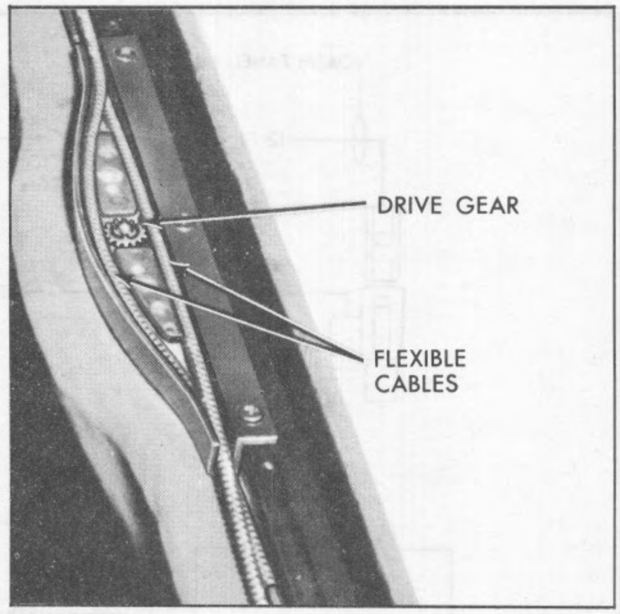


Fig. 15-40 Drive Gear And Cables

Four plastic drain tubes, two on each side, are incorporated in the windshield pillar area and in the rear quarter area to catch water seepage that may bypass the weatherstrip seal around the roof opening. The two forward tubes, Fig. 15-41, are routed from the roof panel trough down through the right and left windshield pillars, and out through the rocker panels. The rear drain tubes are routed through the rear quarter panel and drain through the rear wheel housings.

Electrical System

The electrical circuit for the Sunroof is protected by a 25-amp circuit breaker on the left hand instrument panel brace underneath the instrument panel pad.

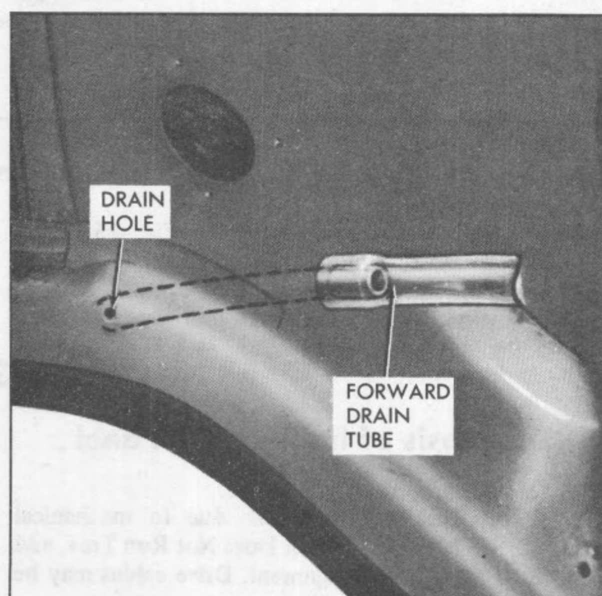


Fig. 15-41 Forward Drain Tube Left Side

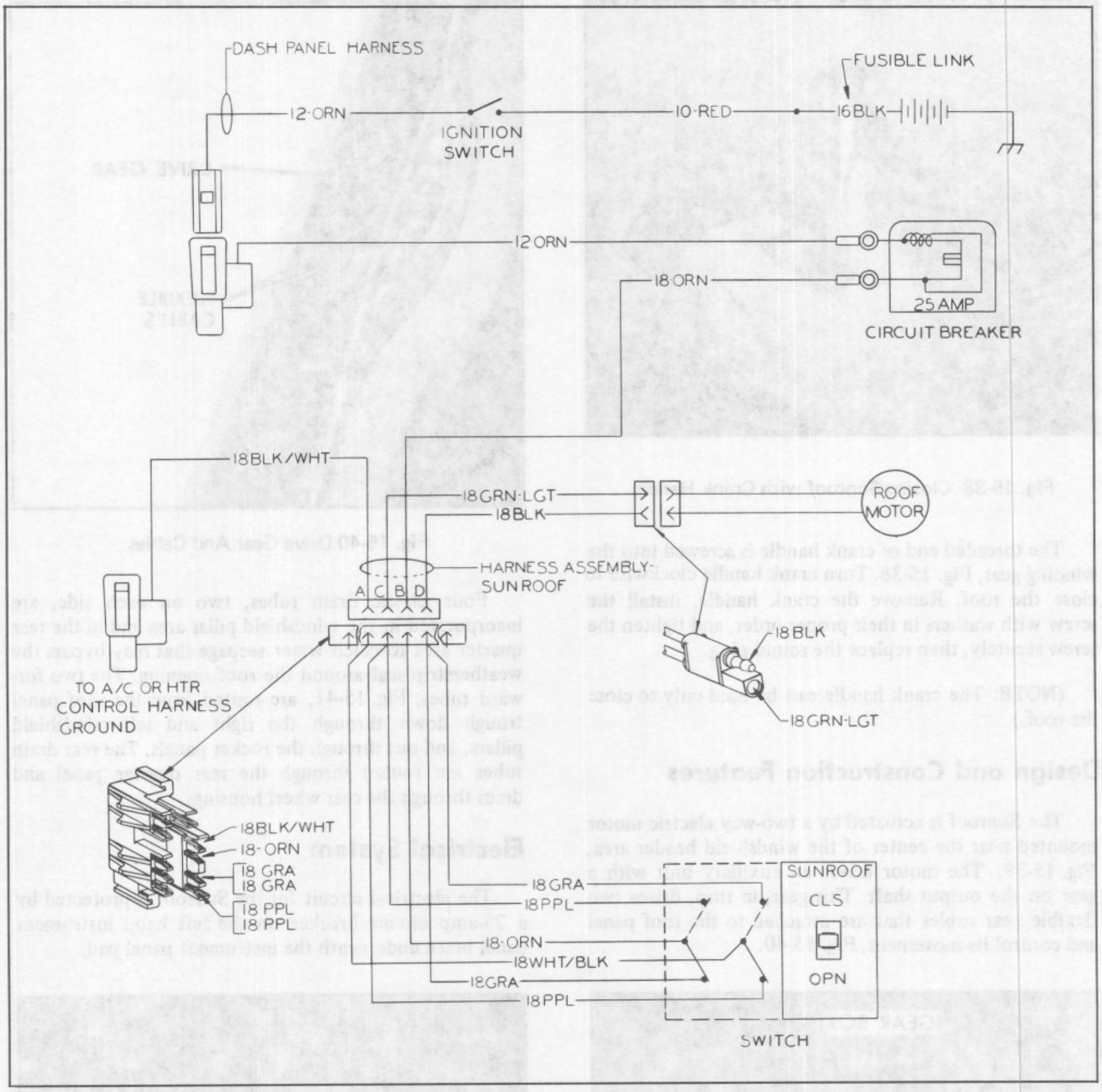


Fig. 15-42 Sunroof Circuit Diagram

Electrical power for the system, Fig. 15-40, is supplied from the fuse block through an orange wire to the 25-amp circuit breaker. Another orange wire is routed from the circuit breaker to a four-way connector that leads to the control switch on the instrument panel. An orange feed wire leads to the switch. Two wires – black for the open cycle and light green for the close cycle – are routed from the switch to the motor.

DIAGNOSIS

44. Diagnosis of Inoperative Panel

1. Motor runs, panel fails to rise.

a. Panel does not run true due to mechanical resistance; see Note 46d, Panel Does Not Run True, and Note 46e, Cable Guide Alignment. Drive cables may be disconnected or broken.

b. Front slides are tilted and require alignment; see Note 46c, Ramp Alignment.

(1) Remove winding gear access plug, Fig. 15-37.

(2) Unscrew slotted-head screw, and add another washer (shim) to those already in position.

(NOTE: Special washers are listed in the parts catalogue, under Group 14.560.)

(3)Replace screw and check operation.

(4) Tighten slotted-head screw securely.

2. Motor Fails to Run (Fig. 15-42).

a. Check continuity of circuit breaker and wiring connector at control switch.

b. Check control switch to assure electrical continuity to motor.

c. Check wiring and connections to motor. Check motor ground wire.

d. Replace motor.

SERVICE INFORMATION

45. Headlining Panel

a. Removal

1. Open roof panel approximately three inches.
2. Remove two screws securing headlining panel to roof panel at front corners.
3. Slide headlining panel forward and out of seven retaining clips mounted on roof panel front edge, Fig. 15-43.
4. Retract roof panel to full open position.
5. Remove headlining panel reinforcement bow from headlining by removing tape from bow and sliding bow rearward and off the headlining material, Fig. 15-44.
6. Close roof panel approximately three inches to permit rear of headlining frame to fall clear of roof panel rear hooks.
7. Grasp headlining panel front edge and pull it forward and out of side guide rail lower tracks.

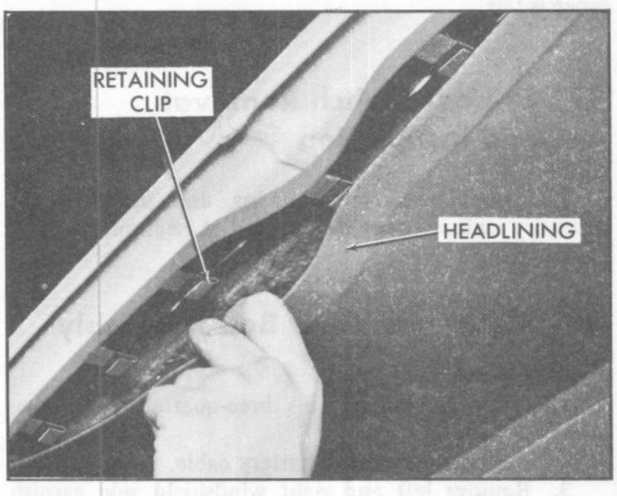


Fig. 15-43 Headlining Panel Removal

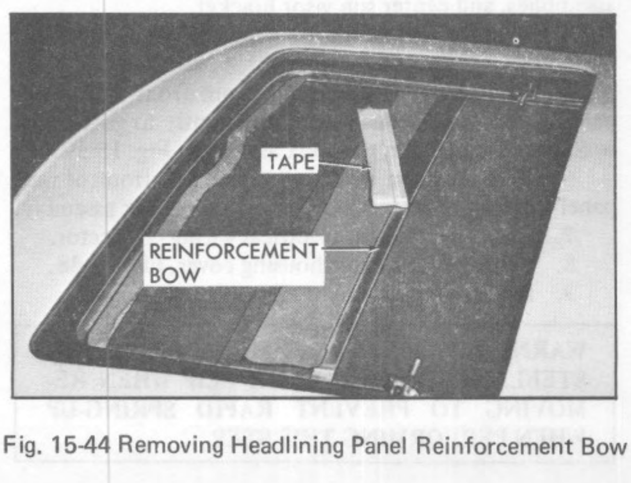


Fig. 15-44 Removing Headlining Panel Reinforcement Bow

b. Installation

1. Retract roof panel to full open position.
2. Align headlining panel with side guide rail lower tracks and move rearward into proper position.
3. Install reinforcement bow on headlining and cover bow with tape.
4. Close roof panel part way, leaving it open approximately three inches.
5. Replace headlining panel and secure with seven retaining clips.
6. Install two screws at front corners of headlining panel.

46. Adjustments and Related Repairs

a. Panel Alignment, Front Left or Right

1. To obtain a flush fit with the roof on one side of front of roof panel, loosen both front slide screws, Fig. 15-45.
2. Turn knurled nuts clockwise to raise roof panel and counterclockwise to lower panel, Fig. 15-45.
3. After proper alignment is obtained, tighten screws.

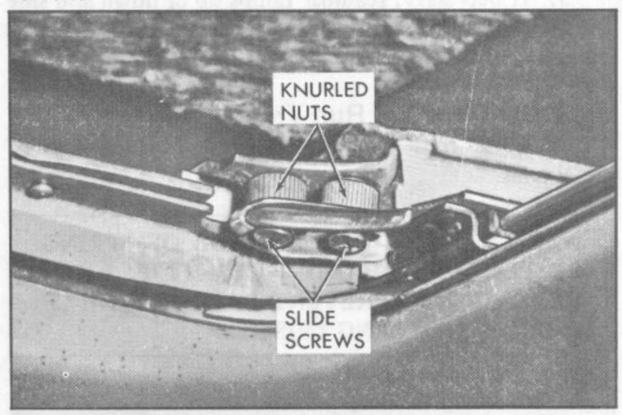


Fig. 15-45 Front Panel Alignment

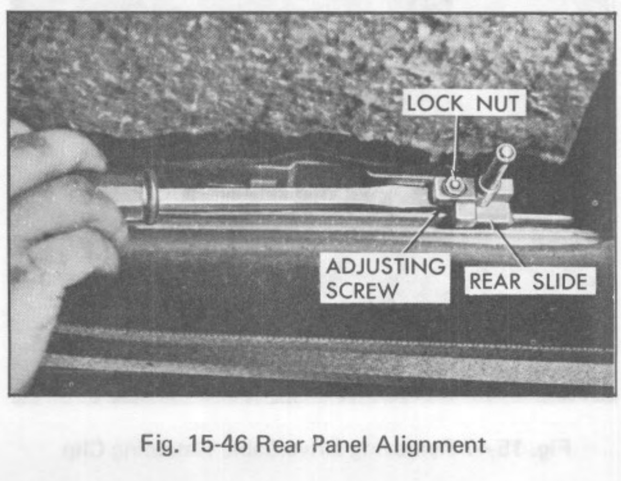


Fig. 15-46 Rear Panel Alignment

4. Adjust opposite front slide in same manner if required.

b. Panel Alignment, Rear Left or Right

1. To obtain a flush fit with the roof on one side of rear of roof panel, loosen 3/8" locknut on rear slide, Fig. 15-46.

2. Using a screwdriver, turn adjusting screw clockwise to raise roof panel and counterclockwise to lower panel, Fig. 15-46.

3. After proper alignment is obtained, tighten locknut.

4. Adjust opposite rear slide in same manner, if required.

c. Ramp Alignment

1. If roof panel does not rise into roof opening during closing cycle, remove headlining panel from roof panel and open roof panel to full rearward position.

2. Examine ramps in drainage channel, Fig. 15-35 to determine if they are properly aligned with lifting elements at rear of panel.

(NOTE: The point where lifting element makes contact with ramp can be seen on rearward slope of ramp.)

3. Using a screwdriver or similar tool, pry ramp up and move ramp side to side until it is centered with lifting element.

4. Close roof panel and note lifting action of panel.

5. If necessary, readjust ramps up or down and side to side, until proper lifting action of roof panel is obtained.

d. Panel Does Not Run True

1. Close roof panel to determine which side of panel jams.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

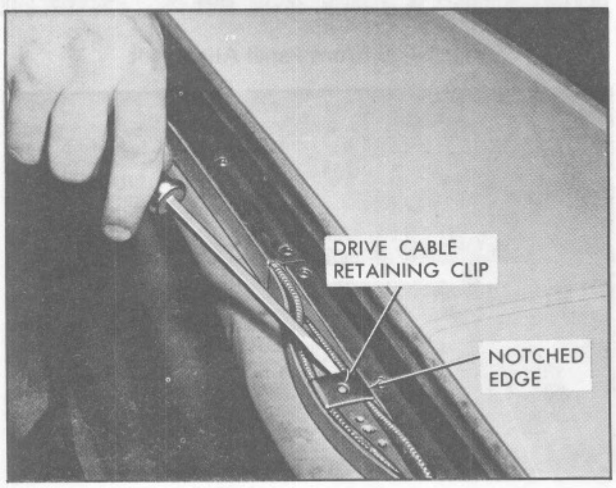


Fig. 15-47 Removing Drive Cable Retaining Clip

2. Open roof panel, remove drive housing center cover and pry off drive cable retaining clip, Fig. 15-47.

3. To move right hand side of roof panel forward, lift right cable at front of pinion and pull it one or more teeth to the left.

4. Install retaining clip and drive housing cover and check operation.

5. To move left hand side of roof panel forward, perform similar operation on left cable.

(NOTE: Do not move panel while cable is off pinion.)

e. Cable Guide Alignment

1. If roof panel jams during its travel, check both front corner lower elbow guides for alignment with front and side guides.

2. If necessary, shim lower elbow guides to move guides inboard for alignment with adjacent guides.

3. If panel fails to rise, the joints of cable slides are out of alignment (guide rail, corner and connector guides, and cable drive housing) and are jamming cable drive.

a. Loosen screws retaining the guide rails, corner and connector rails, and cable drive housing a few turns.

b. Retighten the screws one by one, continually activating the drive mechanism.

c. Where necessary, realign those points where resistance is felt.

47. Sunroof Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Section 12, Note 61.

48. Motor and Gear Box Assembly

a. Removal

1. Open Sunroof to three-quarter full open position.

2. Disconnect negative battery cable.

3. Remove left and right windshield side garnish moldings, roof side rail garnish moldings, both sun visor assemblies, and center sun visor bracket.

4. Remove left and right windshield upper garnish moldings.

5. Carefully pull headlining from front roof inner panel at top of windshield area sufficiently to gain access to Sunroof motor and gear box assembly, Fig. 15-39.

6. Remove foam insulator padding in front of roof panel opening adjacent to motor and gear box assembly.

7. Disconnect motor electrical wiring connector.

8. Remove drive cable housing cover, Fig. 15-48.

9. Remove left and right elbow corner guides.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

Fig. 15-48 Removing Drive Cable Housing Cover

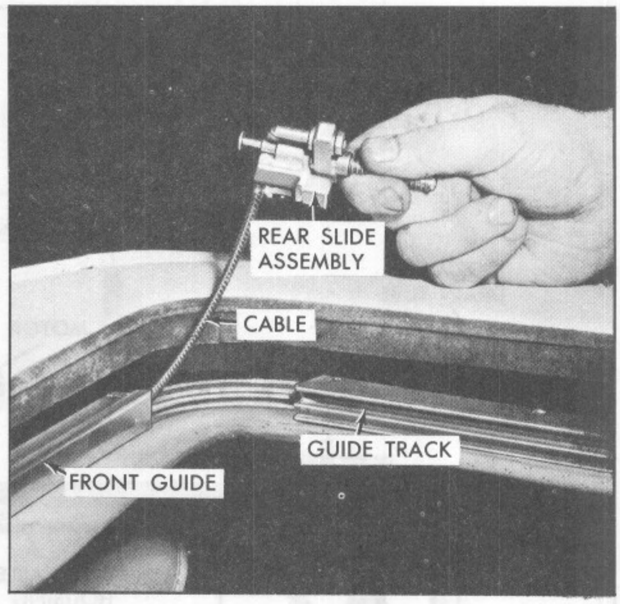


Fig. 15-49 Removing Rear Slide And Cable

10. Using a small screwdriver, carefully pry up drive cable retaining clip, Fig. 15-47.
11. Pull drive cables out of upper and lower front guides, observing routing of cables in guides for installation purposes.
12. Remove three screws retaining drive cable housing and remove housing.
13. From top area, remove two gear box assembly retaining screws and remove gear box assembly with motor.

b. Installation

1. Push plastic cover over motor to base of gear box.
2. Position motor and gear box assembly in drive cable housing.
3. Install two retaining screws.
4. Install drive cable housing with three retaining screws.
5. Insert ends of cables into guides, observing same cable routing as when removed. Lubricate cables and drive gear with #70 grade lubriplate or equivalent.
6. Install right and left elbow corner guides.

(NOTE: Alignment of lower elbow corner guide is of utmost importance, Fig. 15-49.)

7. Install cable retaining clip by pressing down firmly with thumb.
8. Install drive cable housing cover.
9. Connect motor electrical wiring connector and battery cable, and check operation of system.
10. Apply cement to foam insulation padding and install padding.
11. Apply trim cement sparingly to forward edge of roof panel. Starting at center, position headlining to front roof inner panel forward edge. Smooth out all wrinkles, working from center to outboard ends.
12. Install roof side rail garnish moldings, windshield upper and side garnish moldings, center sun visor bracket, and sun visors.

CAUTION: Be careful not to pinch drain tubes when installing windshield side garnish moldings.

13. Close Sunroof.

49. Sunroof Panel, Rear Slide, and Cable (Fig. 15-50)

a. Sunroof Panel Removal

1. Open Sunroof approximately three inches.
2. Remove two screws from front of headlining panel that secure headlining to roof panel.
3. Slide headlining panel forward and out of seven retaining clips on roof panel front edge, Fig. 15-43. Close roof and push headlining panel to full rearward position.
4. Remove outboard screw from each front slide assembly, Fig. 15-51.
5. Loosen inboard slide screw and rotate each front slide assembly inboard to clear guide rail, Fig. 15-52.
6. Pull each rear slide and cable assembly inboard and out of slide retainer hole in roof panel, Fig. 15-53.
7. Lift roof panel at front edge and pull panel forward and out of roof opening.

b. Rear Slide and Cable Removal

(NOTE: If only one cable is defective, replace both. This assures parallel travel of roof panel.)

1. Remove drive cable housing cover, Fig. 15-48.
2. Remove both front upper elbow guides.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

3. Using screwdriver, pry off drive cable retaining clip.

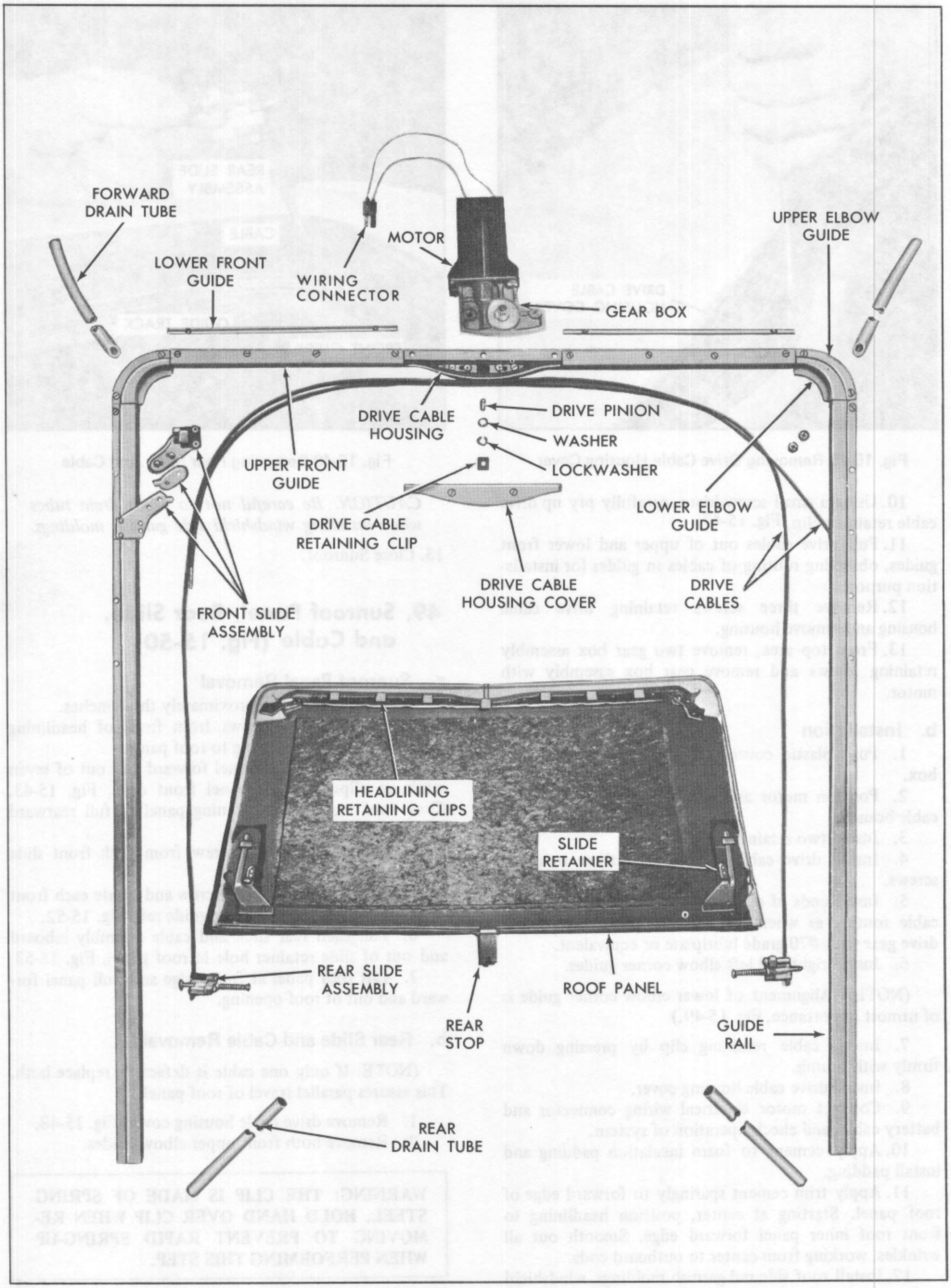


Fig. 15-50 Roof Panel Disassembled

4. Pull free end of one cable out of guide rail and drive housing, and pull cable and rear slide assembly forward to front corner, Fig. 15-54.

5. Remove slide from guide track and pull cable out of front guide, Fig. 15-49.

6. Remove opposite cable in same manner.

c. Rear Slide and Cable Installation

1. Position left rear slide in guide track and move slide and cable assembly back until slide is centered with the fifth side guide rail screw from the front, Fig. 15-55.

2. Slide free end of cable into upper front guide, Fig. 15-56, and route cable through the curved front center track in drive cable housing and into lower track on right side. Do not engage cable in drive pinion teeth, Fig. 15-57.

3. Install right slide and cable assembly in same manner as left slide and cable assembly, except that right cable is routed in straight center track in drive cable housing and into lower track on left side, Fig. 15-57.

(NOTE: Make sure right slide is centered with fifth screw from front right guide rail. Do not engage cable in drive pinion teeth.)

4. Check both front corner lower elbow guides for alignment with front and side guides. If necessary, shim lower elbow guide to move guide inboard for alignment with adjacent guides.

5. Lubricate cables at the areas of the elbow guides with #70 grade lubriplate or equivalent and install both front corner upper elbow guides.

6. Recheck rear slides for center position with fifth screw from front on side guide rails, Fig. 15-56. With slides in this position, engage cables in drive pinion teeth.

CAUTION: This operation is critical to assure roof panel alignment and prevent cable breakage.

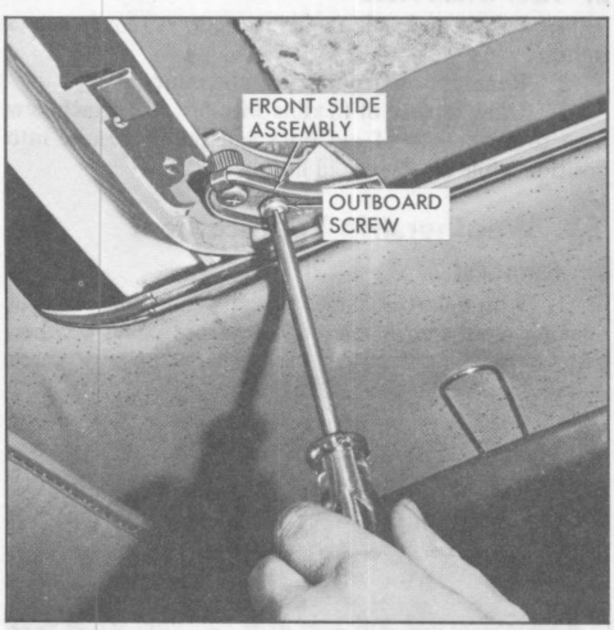


Fig. 15-51 Removing Outboard Screw From Front Slide Assembly

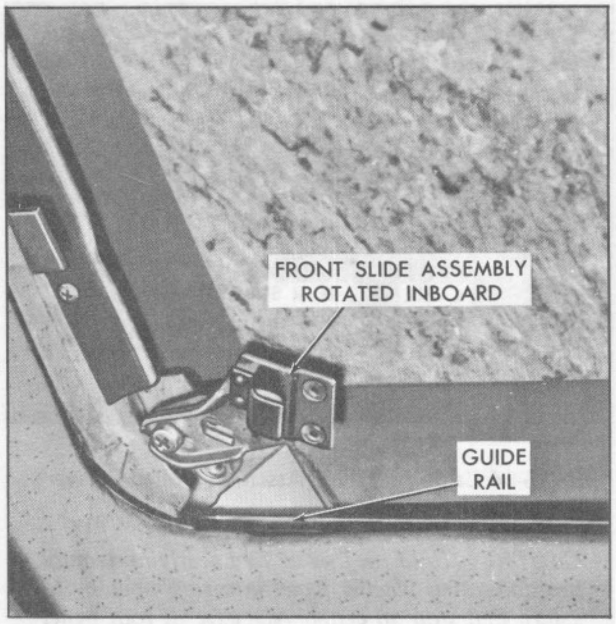


Fig. 15-52 Front Slide Assembly Clear Of Guide Rail

7. Lubricate cables and drive pinion teeth with #70 grade lubriplate or equivalent and install drive cable retaining clip.

8. Install drive cable housing cover, being careful not to overtighten screws.

9. Actuate switch to check cable operation, then return rear slides to fifth screw from front on side guide rails.

d. Roof Panel Installation

1. With headlining panel in full rearward position, install roof panel into roof opening.

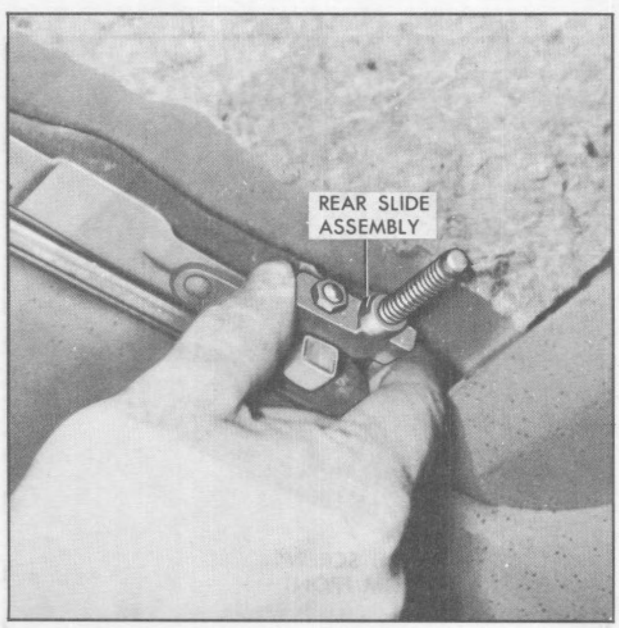


Fig. 15-53 Removing Rear Slide And Cable Assembly From Retainer

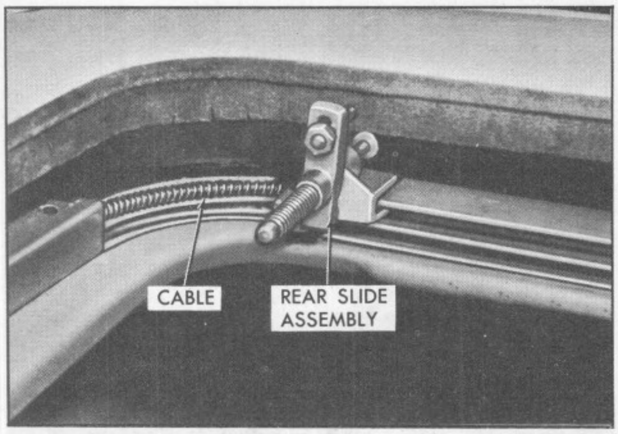


Fig. 15-54 Cable And Slide Assembly Pulled Forward

CAUTION: Hold roof panel in a nearly horizontal position when placing panel into roof opening to assure that stop on center rear edge of roof panel does not damage passenger compartment headlining.

2. Move each front slide assembly outboard and install slides on guide rail upper tracks.
3. Install outboard screws and tighten both screws on each slide, Fig. 15-45.
4. Push roof panel to full forward position by hand.
5. Lift rear of roof panel upward and actuate control switch to position rear slides into alignment with holes on slide retainers on roof panel, Fig. 15-53.
6. Engage each rear slide pin into retainer hole and install retainer spring plate on slide pin.
7. Actuate switch, check operation of roof panel, and note fit of panel to roof. If any adjustments are necessary, refer to Note 46.
8. Install headlining on roof panel.

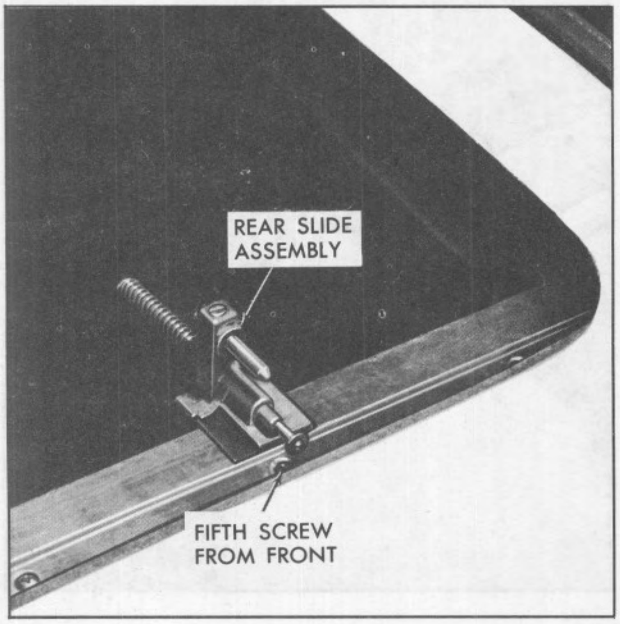


Fig. 15-55 Rear Slide In Centered Position

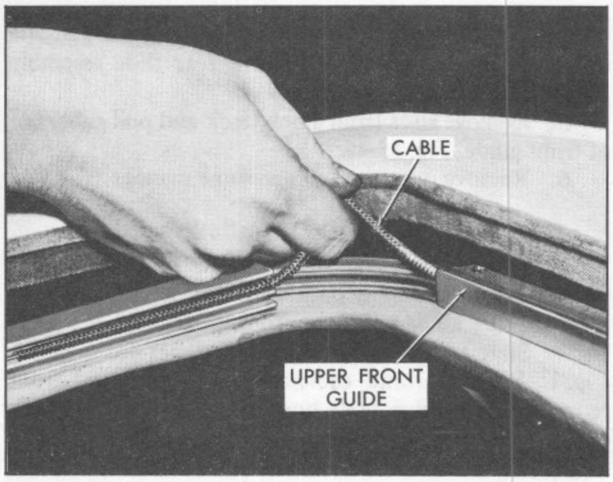


Fig. 15-56 Installing Cable Into Upper Front Guide

50. Drain Hose Replacement

a. Front Drain Hose

1. Perform Steps 3, 4, and 5, in Note 48a, and carefully pull headlining away from top of windshield area sufficiently to gain access to either front drain hose, Fig. 15-41.
2. Remove kick pad trim panel.
3. Remove hose from drain tube outlet at top.

(NOTE: Adhesive is used to secure hose to outlet.)

4. Using a piece of flexible wire or cord, attach new hose to lower end of old hose and pull new hose into position while removing old hose.
5. Secure new hose to drain tube outlet with weatherstrip adhesive.
6. Install headlining, garnish moldings, sun visors, and bracket as described in Note 48b, Steps 11 and 12.

b. Rear Drain Hose

1. Pull down headlining at rear corner to gain access to hose.
2. Remove hose from drain tube outlet at top.
3. Using a piece of flexible wire or cord, attach new hose to lower end of old hose and pull new hose into position while removing old hose.

51. Weatherstrip Replacement

a. Removal

1. With Sunroof panel closed, mark joint of roof opening weatherstrip rear edge and roof panel weather-

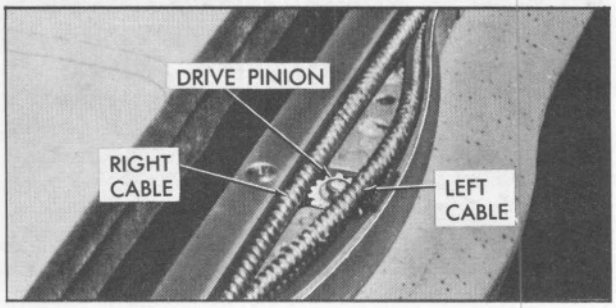


Fig. 15-57 Drive Cables Installed

strip front edge on both the roof panel and roof at both sides of vehicle.

2. Remove roof panel assembly from vehicle, as described in Note 49a.

3. Remove weatherstrips from roof panel opening and from rear edge of roof panel.

b. Installation

1. Clean surfaces using a suitable cement solvent.

2. Apply weatherstrip cement to both surfaces.

3. Position roof opening weatherstrip slightly below flush of roof and align one end of weatherstrip with mark on roof assembly. Cement weatherstrip to roof opening.

4. Install weatherstrip on rear edge of roof panel in same manner as roof opening weatherstrip described in Step 3.

(NOTE: Roof panel weatherstrip is also retained with trim nails.)

5. Install roof panel assembly into roof opening, as described in Note 49d.

52. Periodic Maintenance

a. Lubrication

1. During cable replacement, lubricate cables with #70 grade lubriplate or equivalent.

2. Periodically clean off any dirt that may have accumulated on guide rail covers.

CAUTION: Do not lubricate top surface of guide rail covers as this will cause streaks on headlining material.

b. Drain Tubes

1. During regular maintenance, check the two drain holes at the front corners of the roof panel, Fig. 15-34 to make certain they are open and free of foreign material. If drains are plugged, they can be cleaned with an air hose or flexible wire. If they cannot be cleaned in this manner, they must be replaced.

2. To clean rear drain tubes, use an air hose or flexible wire from the bottom of the tubes.

CUSTOM CABRIOLET PADDED ROOF

The optional Custom Cabriolet padded roof is offered for both the Coupe DeVille and Eldorado Coupe. For information on the Coupe DeVille option, refer to the Body Service Manual.

The following procedures cover removal and installation of the Eldorado Custom Cabriolet padded roof and back window, Fig. 15-58.

53. Cabriolet Padded Roof

a. Removal

1. Remove weatherstripping from body pillar channel and remove pillar channel molding by removing five retaining screws, Fig. 15-59.

2. Loosen back window inside garnish molding. Remove lens on courtesy lamp and two screws in lamp housing. Remove coat hangers.

3. Remove pillar garnish moldings. Remove upper inner trim panel.

4. Unbolt and remove rear quarter glass.

5. Remove two screws from lower ends of roof cover band.

6. Pry off center molding cap and remove screws on ends of moldings. Pry off moldings.

7. Pry off wreath and crest.

8. Pull vinyl cover and padding from under back window reveal molding and from body surface, then clean up surface.

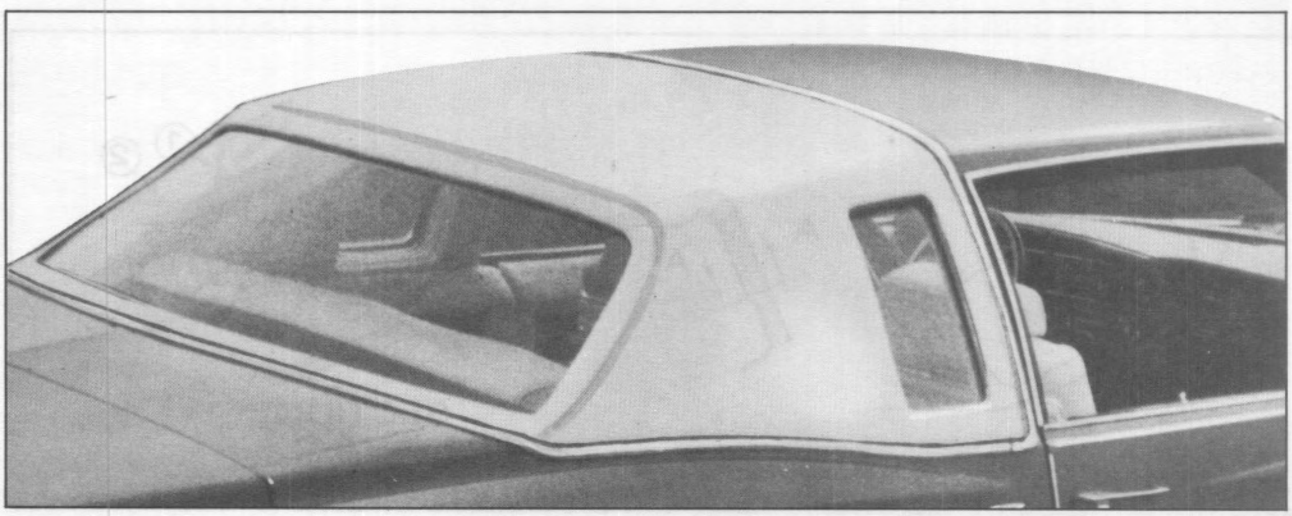


Fig. 15-58 Eldorado Custom Cabrolet Padded Roof

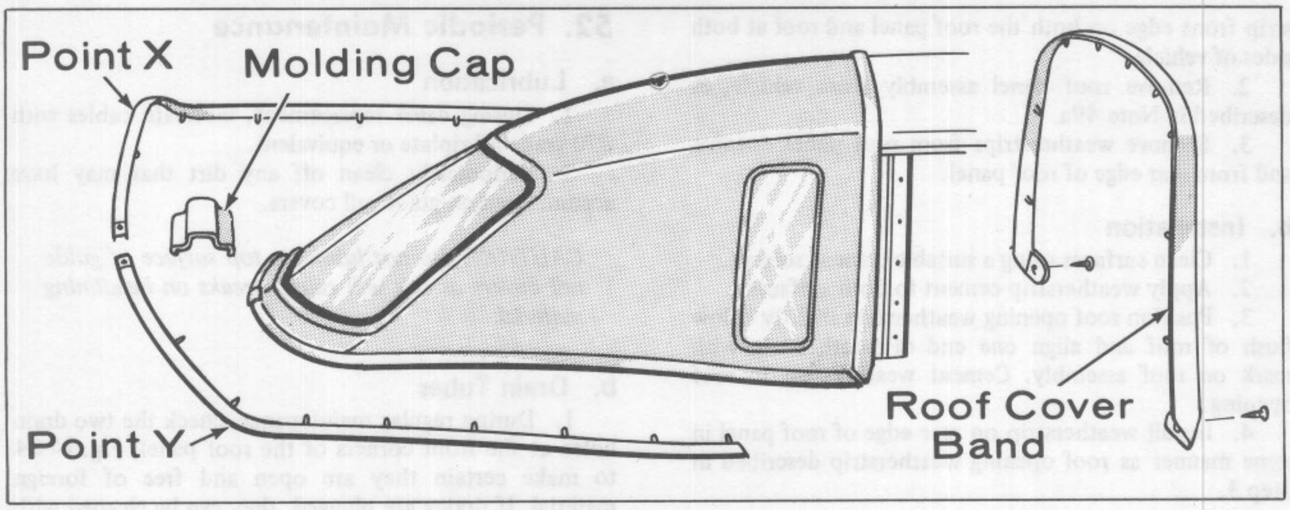


Fig. 15-59 Padded Roof Attachments

(NOTE: Some roofs incorporate a plastic ring in place of the factory reveal molding. This ring must be removed prior to back glass removal.)

b. Installation

1. Install new foam padding and vinyl roof cover.
2. Apply silicone sealer to all edges of vinyl.
3. Wrap vinyl and insert under back glass molding using putty knife or similar flat bladed tool.
4. Install moldings, beginning at points X and Y, Fig. 15-58.
5. Install screws on ends of molding and center molding cap.
6. Install wreath and crest.
7. Install rear quarter glass.
8. Install upper inner trim panel, courtesy lamp, lamp lens and coat hangers.
9. Install pillar channel, channel molding and weatherstripping.
10. Install all garnish moldings.

54. Cabriolet Back Window

a. Removal

1. Remove vinyl cover and padding from area of back window as follows:
   a. Cut silastic sealant with sharp instrument, such as razor blade, 1 in Section A-A-1, Fig. 15-60.
   b. Pull vinyl cover from under reveal molding, 2 in Fig. 15-60.
   c. Roll back vinyl and tape to surface surrounding back window, 3 in Section A-A-2.
2. Cut and strip foam pad (approx. 2" in width) around entire perimeter of window, 4 in Fig. 15-60.
3. Remove back window moldings and glass using servicing procedures given in the Body Service Manual.

b. Installation

1. Install back window and moldings using service procedures given in the Body Service Manual.

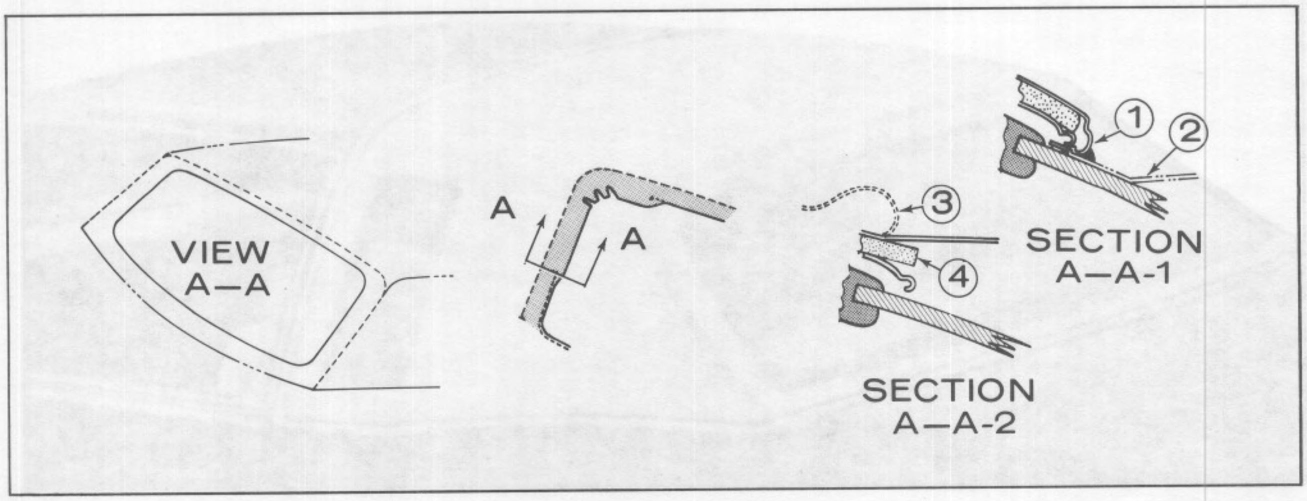


Fig. 15-60 Back Window Attachments

2. Install foam pad around perimeter of window using vinyl roof adhesive.

3. Wrap vinyl over foam pad and insert under molding using putty knife or similar flat-bladed tool.

4. Apply General Electric Silicone Auto Glass Sealant or equivalent around entire perimeter.

5. Clean excess sealant from glass and vinyl surfaces.

THEFT DETERRENT SYSTEM

GENERAL DESCRIPTION

As a factory-installed option, an electronic Theft Deterrent System is designed to provide additional protection for the vehicle, its contents, the trunk, and underhood areas. This system is operated by the ignition switch and the selector switch in the glove compartment.

Alarm Description

The alarm afforded by the Cadillac Theft Deterrent System consists of pulsating the vehicle's horns at a rate of 50 cycles per minute, along with the simultaneous flashing of the parking, side marker, tail, and license lamps. The unique, periodic sounding of the horn and flashing of exterior lamps which are visible from all quarters of the car should attract the attention of nearby observers. In order to conserve vehicle battery power, the alarm shuts off after three to five minutes of operation and re-arms.

Hood Switch

The plunger-type hood switch is located on the left side of the radiator tie bar in a position where it can sense a small movement of the hood. It is a grounding-type switch similar to those used at door lock pillars.

Trunk Light

Opening of the trunk is detected electronically when the trunk-light bulb goes on. Similarly, any light bulb in the car is detected by voltage-sensing of the entire electrical system, including brake lights, courtesy lights, map light, illuminated vanity mirror, glove compartment light, etc.

Fuse Block

A special cover is placed over the fuse block and held in place by the horn and window circuit breakers; removal of the horn circuit breaker causes the alarm to activate. Sensing and control wires are carried by specific dash and foward lamp harnesses.

System Diagram

Fig. 15-61 illustrates the system in a schematic fashion. The hood switch, door jamb switches, the horn circuit breaker, or any resistive electrical load "trigger" the controller which is powered by the vehicle battery. Internal logic circuits are tuned to emphasize response to light bulbs, while ignoring small inductive loads. The controller contains an internal timing circuit and relay which flash the lamps and operate the vehicle horns intermittently.

Controller

The solid-state controller contains discrete electronic components and a power relay. Its operation is two-stage, as it must become "armed" before it can be "triggered". The controller can only be serviced by replacement.

Glove Compartment/Selector Switch Area

The manual selector switch is located in the glove compartment, and its instruction label is located on the glove compartment door. The two positions of the selector are labelled "ARM ENABLE" and "ARM PREVENT", corresponding to the advance instruction of an authorized driver when parking the car. Once the system is armed, the selector serves as a "trigger" instead of a control, sounding the alarm immediately if moved to the "ARM PREVENT" position.

Arm Prevent

Two methods are provided to prevent arming of the system, as may be required by certain parking or service situations.

The first is by turning the selector switch in the glove compartment to its "ARM PREVENT" position prior to completion of the arming period. (With ignition on, or within 30 seconds after switching ignition off.) The system will then remain disarmed until the selector is restored to the "ARM ENABLE" position.

The second, or temporary, arm-prevent method is by turning the ignition key to the "Accessory" position for 5 seconds before withdrawing the key; this will prevent arming for that single parking interval of the car until the ignition has again been turned on and off.

Location of Parts

As shown in Fig. 15-62, the electronic sensor and controller is located beneath the shroud panel reinforcement support where it is accessible only after removing the instrument panel pad assembly. The manual control switch is located in the upper left-hand

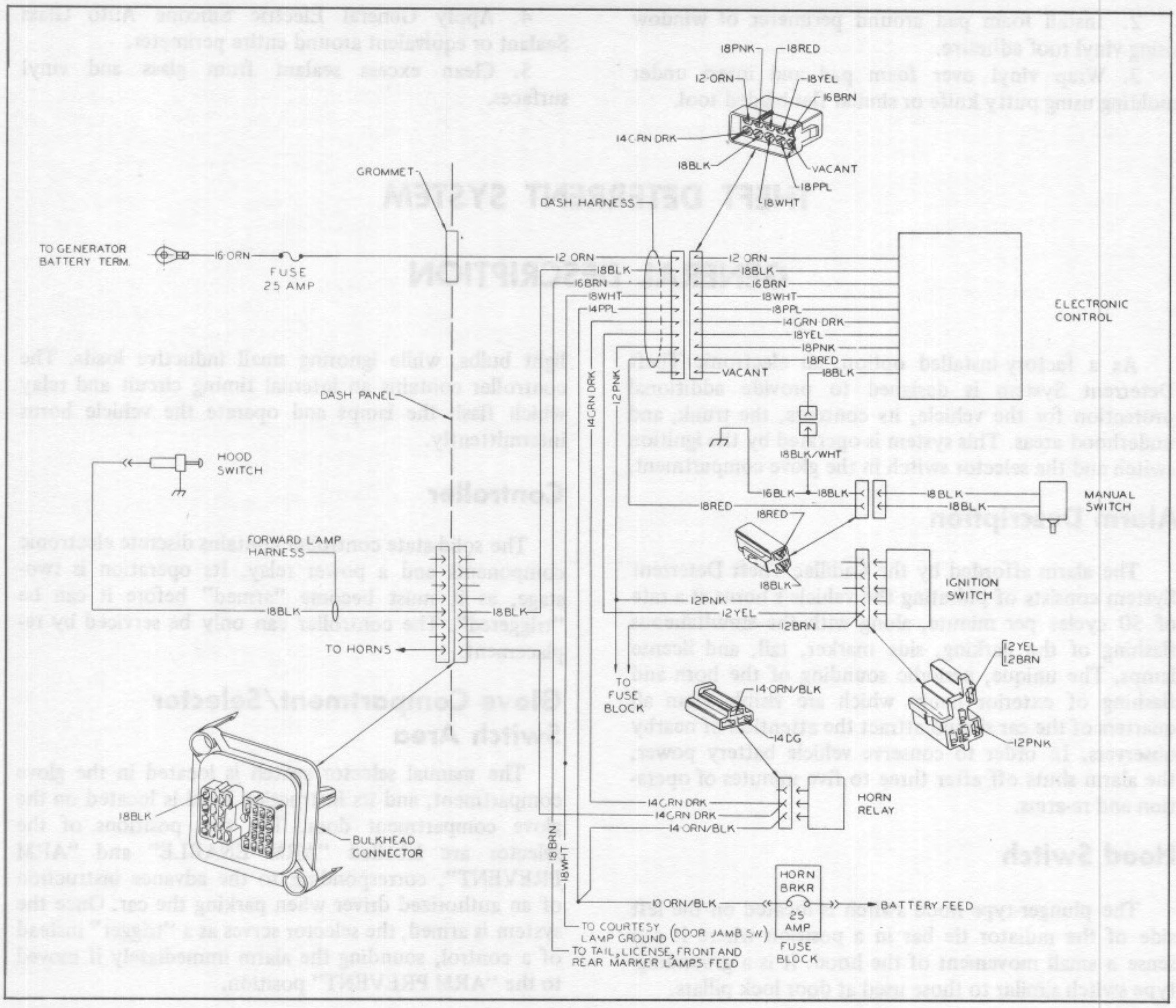


Fig. 15-61 Theft Deterrent Circuit Diagram

corner of the glove box, and its label is attached to the glove box door. The hood sensing switch is installed in the left-hand side of the radiator cradle tie bar in a position inaccessible when the hood is closed or on "Safety"; the switch operates as the hood raises to its "First" or "Safety" position.

Arming

With the selector in "Arm Enable" position, the system becomes automatically armed 1 to 1-1/2 minutes after the ignition is turned off. If a door is held open before completion of the arming period, arming will be held off until after all the doors are closed. Arming occurs automatically and does not require action by the driver.

Disarming

The system is disarmed electrically by turning the ignition switch to its "Run" or "Accessory" position. This must be done within 20 seconds after any door is opened, or the alarm will sound.

Alarm Activation

If the system is armed, the alarm will be activated electrically by any one of seven "triggers": (1) within 20 seconds after any car door is opened, (2) when the hood is opened, (3) when the trunk is opened, (4) when the glove box is opened, (5) if a resistance-type electrical load is switched on, (6) if the fuse block cover is removed, or (7) if the manual control switch in the glove box is moved to the "Arm-prevent" position. If a car door has not been opened first, all "triggers" cause immediate alarm activation. If a door is opened first (or the courtesy lights are switched on), all "triggers" except hood and fuse block will be delayed for 15 seconds. Opening the hood or removing the fuse block cover will set off an immediate alarm, whenever the ignition has been off for 10 seconds or longer, unless the driver has prevented arming.

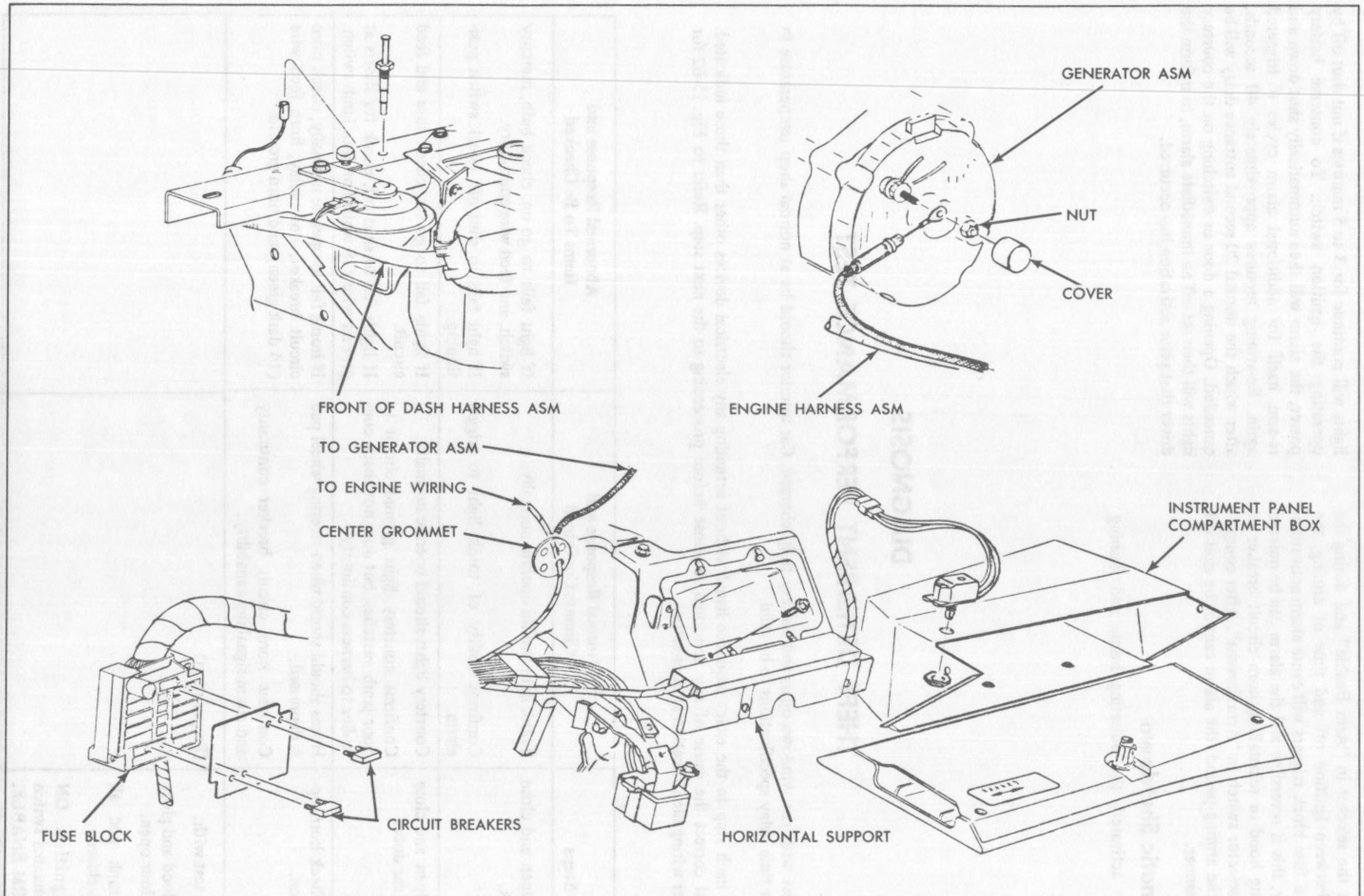


Fig. 15-62 Theft Deterrent Components

With the selector in "Arm Enable" and during the period between ignition off and time of arming, the hood and fuse block triggers will cause alarm activation. However, this is reversible and the alarm can be quieted by closing hood or reinstalling horn circuit breaker or putting selector switch in "Arm Prevent". After completion of the arming period, the alarm cannot be shut off in this manner.

Automatic Shutdown

When activated, the pulsating horns and flashing lights will continue for 3 to 5 minutes if not shut off by operating the ignition switch. To conserve battery power, the alarm will then automatically shut down and re-arm itself for additional alarm cycles if triggered again. Re-arming requires approximately 40 seconds, after which the normal 20 second entrance delay will be cancelled. Opening a door or switching on the courtesy lights will then set off an immediate alarm, to inform the driver that prior activation has occurred.

DIAGNOSIS

THEFT DETERRENT PERFORMANCE TEST

Begin test with car windows open and battery fully charged. Car interior should be at normal shop temperature in order for time delay specifications to be valid.

Perform each step in the exact sequence listed without actuating any electrical devices other than those indicated. Find and correct the cause of any abnormal response before proceeding to the next step. Refer to Fig. 15-62 for controller wiring identification at connector.

Steps	Normal Response and Circuits Confirmed	Abnormal Response and Items To Be Checked
1. A. Open and close trunk.	Trunk light should operate normally. Confirms ability of trunk light to trigger alarm.	If light fails to go on, check bulb, mercury switch, and feed wire continuity. If light fails to shut off, check switch positioning.
B. Open and close each car door.	Courtesy lights should operate normally. Confirms courtesy light ground circuit to door jamb switches, but does not check controller to harness continuity.	If lights fail to go on, check fuse and feed circuit. If lights fail to shut off, check for shorts at ground wire (18 white) or door jamb switch.
C. Check horn operation.	Horns should sound when steering wheel pad is depressed. Confirms horn circuit breaker continuity and alarm signalling capability.	If horns fail to operate normally, check horn circuit breaker, horn relay, horn feed wire (14 dark green), and horn ground.
2. Start test with: A. Hood and glove box door open. B. Trunk and all doors closed. C. Ignition ON and manual switch in ARM ENABLE.	(Preparation)	

THEFT DETERRENT PERFORMANCE TEST (Cont'd.)

Steps	Normal Response and Circuits Confirmed	Abnormal Response and Items To Be Checked
3. A. Turn ignition OFF.	Alarm should activate within 10 seconds. Confirms continuity of ignition feed and battery feed, and grounding of hood switch circuit. Does not check hood switch individually. Horns and lights should pulsate approximately 50 cycles per minute.	If alarm fails to activate, check ignition feed (18 pink) and battery feed (12 orange), then check for short in manual switch or circuit from controller (18 red). Also check for an open controller ground circuit (18 black/white). If horn sounds steadily, disconnect horn relay. If corrected, replace relay; if not, replace controller. (No alarm pulsation.)
B. Move manual switch to ARM PREVENT	Alarm should stop. Confirms manual switch circuit continuity to ground.	If alarm continues, check manual switch positioning (wires to R.H. Side), switch and connector continuity, and check for open from 18 red wire to ground.
C. Move manual switch back to ARM ENABLE.	Alarm should resume. (Same as 3A)	If alarm fails to activate, check for shorted manual switch.
D. Turn ignition to ACCESSORY, then to OFF.	Alarm should stop. Confirms either ignition or accessory feed circuit continuity.	If alarm continues, check continuity of accessory feed (18 yellow) to controller.
E. Wait 10 seconds.	No alarm should occur. Confirms accessory feed continuity to controller.	If alarm sounds, check for crossed ignition feed (18 pink) and accessory feed (18 yellow) wires to controller.
4. A. Open door and exit from car.	(Preparation)	
B. Disconnect feed wire connectors at horns (not at relay).	(To minimize disturbance in shop for following tests.)	
C. Close hood, enter car, and close door.	(Preparation)	
5. A. Turn ignition ON.	(Cancels temporary alarm lockout.)	
B. Turn ignition OFF.	(To begin arming.)	

THEFT DETERRENT PERFORMANCE TEST (Cont'd.)

Steps	Normal Response and Circuits Confirmed	Abnormal Response and Items To Be Checked
C. Wait 10 seconds.	No alarm should occur. Confirms hood switch open and hood switch circuit not shorted. Also confirms horn breaker circuit continuity.	If alarm sounds, check for hood switch misadjustment or grounded circuit (18 black). Also check faulty or unplugged horn circuit breaker, or open in the circuit breaker wire to controller (14 purple).
D. Wait an additional 35 seconds (total of 45 seconds from ignition OFF.)	(Preparation)	
E. Depress brake pedal, then release.	No alarm should occur. Confirms arming time above minimum limit for normal voltage and temperature.	If alarm activates, replace controller (insufficient exit delay time).
6. A. Wait an additional 75 seconds (total of 120 seconds from ignition OFF).	(Preparation)	
B. Turn courtesy lights ON, then OFF at headlight switch.	Alarm should activate after 15-20 second delay. Confirms arming time within maximum limit, and also confirms that entrance delay is within limits for normal voltage and temperature.	If alarm activates instantly (without delay) check continuity of courtesy lamp ground to controller circuit (18 white). If alarm activates sooner than 13 seconds or later than 23 seconds, replace controller (incorrect entrance delay).
C. Allow alarm to continue flashing until automatic shutdown (less than 2 minutes), then wait at least 40 seconds longer.	(Preparation for re-arming test.)	
D. Open car door until courtesy lights come on, then close door.	Alarm should activate. Also reconfirms continuity of courtesy light ground circuit.	If alarm fails to activate, check continuity of courtesy light circuit (18 white) from door jamb switches to controller. If continuity OK, replace controller (no re-arming).
7. A. Turn ignition ON, then OFF, and remove key.	(To enable normal arming.)	

THEFT DETERRENT PERFORMANCE TEST (Cont'd.)

Steps	Normal Response and Circuits Confirmed	Abnormal Response and Items To Be Checked
B. Exit from car immediately and close all doors.	(Preparation for maximum signal duration test.)	
C. Wait 4-1/2 minutes after closing doors.	(To allow full arming.)	
D. Open trunk.	Alarm should activate immediately. Confirms voltage sensing from trunk light.	If alarm fails to activate, recheck trunk light bulb, mercury switch, and feed circuit as in Step 1A.
E. Check duration of alarm.	Alarm should continue for 3-5 minutes. Confirms signal duration within limits for normal voltage and temperature. Alarm should shut down after no longer than 7 minutes.	If alarm duration is shorter than 3 minutes or longer than 7 minutes, replace controller (incorrect alarm duration).
8. A. Enter car and turn ignition ON; set manual switch to ARM PREVENT.	(Conclusion of test.)	
B. Open hood and reconnect horn feed wire connectors. Close hood.	No alarm should sound.	If alarm sounds, repeat checks under Steps 1C and 3B.

THEFT DETERRENT
ELECTRICAL CHECK-OUT

Using a non-powered test light, start test with doors, hood and trunk closed and manual switch on "ARM ENABLE". Probe terminals of wiring harness connector as shown in Fig. 15-61.

Wire Colors Terminal Numbers	Brown 1	Yellow 2	Red 3	Pink 4	Orange 5	6	Purple 7	White 8	Black 9	Dk. Green 10	Black/White Extra
	Ext. Lamps	Acc.	Manual Switch	Ign.	Batt.		Horn Brkr.	Courtesy Lamps	Hood	Horns	Separate Ground Connection
1. Connect tester to known good ground on Inst. Panel and each terminal:											
A. Ign. "OFF"	OFF	OFF	OFF	OFF	ON		ON	ON	OFF	OFF	OFF
B. Ign. "ON"		ON		ON							
C. Ign. "ACC"		ON		OFF							
2. Connect tester to known good ground on inst. panel and probe each terminal with ign. in off and:											
A. Sound horn.										ON	
(NOTE: If 1B above checks OK then the dark green wire (10) should energize when the horn is sounded).											
B. Turn headlamps on.	ON										
C. Turn courtesy lamps on.								OFF			
3. A. Ignition in off-clip connected to terminal #5 (Battery)			OFF						OFF		ON
B. Place manual switch in arm prevent			ON								
C. Open Hood									ON		

THEFT DETERRENT DIAGNOSIS CHART

Before using the "THEFT DETERRENT DIAGNOSIS CHART", check the following inter-related electrical components for proper operation:

1. Horns
2. Courtesy Lamps
3. Trunk Lamp.

COMPLAINT	PROBABLE CAUSE	CORRECTION
System inoperative.	Manual switch in "ARM PREVENT".	Place manual switch in "ARM ENABLE".
	Open in one of the following wires: 1. Battery feed (open fuse). 2. Ground wire. 3. Ignition feed.	Repair or replace as needed. Refer to electrical check-out procedure.
	Short in manual switch wire.	Same as above.
	Inoperative or reversed manual switch. Courtesy lights "ON".	Same as above.
	Inoperative controller	Replace after investigating previously listed causes.
Alarm activates shortly after key is turned from "ON" to "OFF".	Misadjusted (closed) hood switch.	Readjust as described in Note 57c.
	Open in one of the following wires: 1. Horn breaker. 2. Accessory feed.	Repair or replace as needed. Refer to electrical check-out procedure.
	Short in hood switch wire.	Same as above.
	Malfunctioning controller.	Replace after investigating previously listed causes.
Alarm can be activated even though switch placed in "ARM PREVENT".	Make sure ignition has been cycled.	Repair or replace as needed. Refer to electrical check-out procedure.
	Open in manual switch wire.	Same as above.
	Malfunctioning or reversed manual switch.	
	Malfunctioning controller.	Replace after investigating previously listed causes.
System operates normally except alarm will not activate when hood opened.	Open in hood switch wire.	Repair or replace as needed. Refer to electrical check-out procedure.
	Inoperative hood switch.	Same as above.
	Malfunctioning controller.	Replace after investigating previously listed causes.
System operates normally except alarm activates immediately upon door opening - (no entrance delay).	Open in door jamb switch wiring to controller.	Repair or replace as needed. Refer to electrical check-out procedure.
	Malfunctioning controller.	Replace after investigating previously listed cause.

SERVICE INFORMATION

(NOTE: Any interruption of battery power will cause the controller to revert to the armed state, regardless of selector switch position. Therefore, when connecting jumper cables or reconnecting battery cables on a theft deterrent system equipped car, expect the car horns and lights to operate as they do when the alarm is activated. This is normal, and the alarm may be shut down by turning ignition key to accessory or run position.)

Things to Look for if Customer Complains of False Alarms

1. Check with the customer to find out if he encountered starting problems in the morning due to a dead battery. If so this will indicate some erratic or continuous load on the battery which may trip the alarm.

2. Check for critically adjusted switches. To do this, arm the alarm; allow three minutes for full arming. Tap lightly on the brake pedal – the alarm should not activate. This will check for adequate travel before the brake lights are activated. Similarly, tap on the glove compartment. Rearm and exit the car. Allow three minutes for full arming then start pulling on the doors, pull on the hood, on the left side close to where the hood contact is, to make sure that there is adequate over travel. Go to the back of the car and bounce on the rear bumper to check if the mercury capsule in the trunk is not too critically adjusted. If all the previously mentioned tests fail to cause an alarm, open the trunk lid to verify that the alarm was indeed armed.

3. Disarm the alarm. Open the hood and disconnect the wire leading to the hood switch. Insulate the terminal so that it does not make contact with ground. Arm the system. Allow three minutes for full arming. With the system still armed reach under the hood and start pulling gently on all wires leading from the battery both in the ground path and in the 12V path. Make sure there is no tension on the fuse holder which feeds the alarm (directly next to the alternator). Tap lightly on the fuse holder. Any erratic connection will cause an alarm.

4. Remove positive and negative battery cables at battery and check terminal and bolt for corrosion. If corrosion is present, clean terminals thoroughly and reinstall.

5. If none of those steps produced a potential source of false alarms, replace controller (false alarms).

55. Controller Removal and Installation

a. Removal

1. Cycle ignition switch slowly between "ACC" and "LOCK" position.

2. Open glove box door and move manual switch to "ARM PREVENT" position.

3. Remove instrument panel pad assembly as outlined in Section 12, Note 32a.

4. Disconnect controller wiring connector from wiring harness connector, located just above radio receiver.

(NOTE: Controller is located beneath the shroud panel reinforcement support.)

5. Remove mounting screw securing controller and mounting bracket to reinforcement support and remove controller.

(NOTE: No repairs can be made to the controller. If inoperative, it must be replaced as a unit.)

b. Installation

1. Position controller and mounting bracket and secure with one screw.

2. Connect controller wiring connector to wiring harness connector.

3. Install instrument panel pad assembly as outlined in Section 12, Note 32b.

4. Move manual switch in glove box to "ARM ENABLE" position.

5. Cycle ignition switch on and off, wait 1-1/2 minutes to allow for arming time and check system by turning on electrical load.

56. Manual Control Switch Removal and Installation

a. Removal

1. Cycle ignition switch slowly between "ACC" and "LOCK" position.

2. Open glove box door and move manual switch to "ARM PREVENT" position.

3. Reach up through access hole in top of glove box and hold switch while turning switch mounting nut off from inside of glove box.

4. Disconnect switch wiring connector and remove switch.

b. Installation

1. Install switch wiring connector to wiring harness connector.

2. Position switch in mounting hole and secure with nut.

3. Move manual switch to "ARM ENABLE" position.

4. Cycle ignition on and off, wait 1-1/2 minutes arming time and check system by turning on electrical load.

57. Hood Sensing Switch Removal, Installation and Adjustment

a. Removal

1. Cycle ignition switch slowly between "ACC" and "LOCK" position.

2. Open glove box door and move manual switch to "ARM PREVENT" position.

3. Open hood.

4. Reach under left hand side of radiator cradle tie bar and disconnect wiring from sensing switch.

5. Remove nut securing switch to tie bar and remove switch.

b. Installation

1. Position switch through tie bar and secure with nut.

2. Reach under tie bar and connect wiring to switch.

3. Close hood.
4. Open glove box door and move manual switch to "ARM ENABLE" position.
5. Cycle ignition on and off, wait 1-1/2 minutes arming time and check system by opening hood.

c. Switch Adjustment

(NOTE: Make certain that hood is properly aligned and hood primary and secondary latches are properly adjusted.)

1. Cycle ignition on and off. After 10 seconds, exert upward pressure at left front corner of locked hood.
2. If alarm sounds, remove switch and shim with washer(s) as required.
3. Repeat Steps 1 and 2; pull hood release cable.
4. If alarm does not sound, stretch hood pop-up spring to raise hood fully to secondary latch position.

58. Fuse Box Cover Removal and Installation

a. Removal

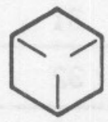
1. Cycle ignition switch slowly between "ACC" and "LOCK" position.
2. Open glove box door and move manual switch to "ARM PREVENT" position.
3. Remove two circuit breakers from fuse block cover and remove cover.

b. Installation

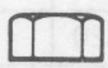
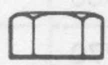
1. Position fuse block cover on fuse block and secure by installing two circuit breakers through cover.
2. Move manual switch to "ARM ENABLE" position.
3. Cycle ignition on and off, wait 1-1/2 minutes arming time and check system by turning on electrical load.

BOLT AND NUT IDENTIFICATION

BOLT STEEL CLASSIFICATION

G. M. MATERIAL NO.	HEAD MARKING	STRENGTH
260-M	 (None)	Standard
280-M	 (120°)	Medium
300-M	 (60°)	High

HEX-NUT STEEL CLASSIFICATION

G. M. MATERIAL NO.	MARKING	STRENGTH
Conventional Type		
286-M	  (None)	Standard
301-M	  USUAL (120°)   OPTIONAL (120°)	High
Prevailing Lock Type (Stover)		
A	 (None)	Standard
B	 (120°)	Medium
C	 (60°)	High

DRILL SIZES

Letter Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches
Z	0.413	1	0.2280	28	0.1405	55	0.0520
Y	0.404	2	0.2210	29	0.1360	56	0.0465
X	0.397	3	0.2130	30	0.1285	57	0.0430
W	0.386	4	0.2090	31	0.1200	58	0.0420
V	0.377	5	0.2055	32	0.1160	59	0.0410
U	0.368	6	0.2040	33	0.1130	60	0.0400
T	0.358	7	0.2010	34	0.1110	61	0.0390
S	0.348	8	0.1990	35	0.1100	62	0.0380
R	0.339	9	0.1960	36	0.1065	63	0.0370
Q	0.332	10	0.1935	37	0.1040	64	0.0360
P	0.323	11	0.1910	38	0.1015	65	0.0350
O	0.316	12	0.1890	39	0.0995	66	0.0330
N	0.302	13	0.1850	40	0.0980	67	0.0320
M	0.295	14	0.1820	41	0.0960	68	0.0310
L	0.290	15	0.1800	42	0.0935	69	0.0292
K	0.281	16	0.1770	43	0.0890	70	0.0280
J	0.277	17	0.1730	44	0.0860	71	0.0260
I	0.272	18	0.1695	45	0.0820	72	0.0250
H	0.266	19	0.1660	46	0.0810	73	0.0240
G	0.261	20	0.1610	47	0.0785	74	0.0225
F	0.257	21	0.1590	48	0.0760	75	0.0210
E	0.250	22	0.1570	49	0.0730	76	0.0200
D	0.246	23	0.1540	50	0.0700	77	0.0180
C	0.242	24	0.1520	51	0.0670	78	0.0160
B	0.238	25	0.1495	52	0.0635	79	0.0145
A	0.234	26	0.1470	53	0.0595	80	0.0135
		27	0.1440	54	0.0550		

DECIMAL EQUIVALENTS

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.5	1	

WEIGHTS AND MEASURES

LINEAR MEASURE

12 inches .... = 1 foot
3 feet .... = 1 yard (1 yd.)

AREA MEASURE

144 square inches .... = 1 square foot
9 square feet .... = 1 square yard (sq. yd.)

CUBIC MEASURE

1,728 cubic inches .... = 1 cubic foot
27 cubic feet .... = 1 cubic yard

LIQUID MEASURE

1 pint .... = 16 ounces
2 pints .... = 1 quart (qt.) = 32 ounces
4 quarts .... = 1 gallon (gal.)
31 1/2 gallons .... = 1 barrel (bbl.)

COMMON WEIGHT

16 ounces .... = 1 pound
100 pounds .... = 1 hundred weight (cwt.)
2000 pounds .... = 1 ton

METRIC EQUIVALENTS

Length

Centimeter (cm)	=	0.3937 in.	In.	=	2.5400 cm.
Meter (m)	=	3.2808 ft.	Ft.	=	0.3048 m.
Meter	=	1.0936 yd.	Yd.	=	0.9144 m.
Kilometer (km.)	=	0.6214 mile	Mile	=	1.6093 km.

Area

Sq. cm.	=	0.1550 sq. in.	Sq. in.	=	6.4516 sq. cm.
Sq. m.	=	10.7639 sq. ft.	Sq. ft.	=	0.0929 sq. m.
Sq. m.	=	1.1960 sq. yd.	Sq. yd.	=	0.8361 sq. m.

Volume

Cu. cm.	=	0.0610 cu. in.	Cu. in.	=	16.3872 cu. cm.
Cu. m.	=	35.3145 cu. ft.	Cu. ft.	=	0.0283 cu. m.
Cu. m.	=	1.3079 cu. yd.	Cu. yd.	=	0.7646 cu. m.

Capacity

Liter (l)	=	61.0250 cu. in.	Cu. in.	=	0.0164 Liter
Liter	=	0.0353 cu. ft.	Cu. ft.	=	28.3162 Liter
Liter	=	0.2642 gal. (U.S.)	Gal.	=	3.7853 Liters
Liter	=	0.0284 bu. (U.S.)	Bu.	=	35.2383 Liters

Liter .... = { 100.027 cu. cm. / 1.0567 qt. (liquid) or 0.9081 qt. (dry) / 2.2046 lb. of pure water at 4° C = 1 kg. }

Weight

Gram (g)	=	15.4324 grains	Grain	=	0.0648 g.
Gram	=	0.0353 oz.	Oz.	=	28.3495 g.
Kilogram	=	2.2046 lb.	Lb.	=	0.4536 kg.
Kilogram	=	0.0011 ton (sht.)	Ton (sht.)	=	907.1848 kg.
Ton (met.)	=	1.1023 ton (sht.)	Ton (sht.)	=	0.9072 ton (met.)
Ton (met.)	=	0.9842 ton (lg.)	Ton (lg.)	=	1.0160 ton (met.)

Pressure

1 kg. per sq. cm.	=	14.223 lb. per sq. in.
1 lb. per sq. in.	=	0.0703 kg. per sq. cm.
1 kg. per sq. m.	=	0.2048 lb. per sq. ft.
1 lb. per sq. ft.	=	4.8824 kg. per sq. m.
1 kg. per sq. cm.	=	0.9678 normal atmosphere

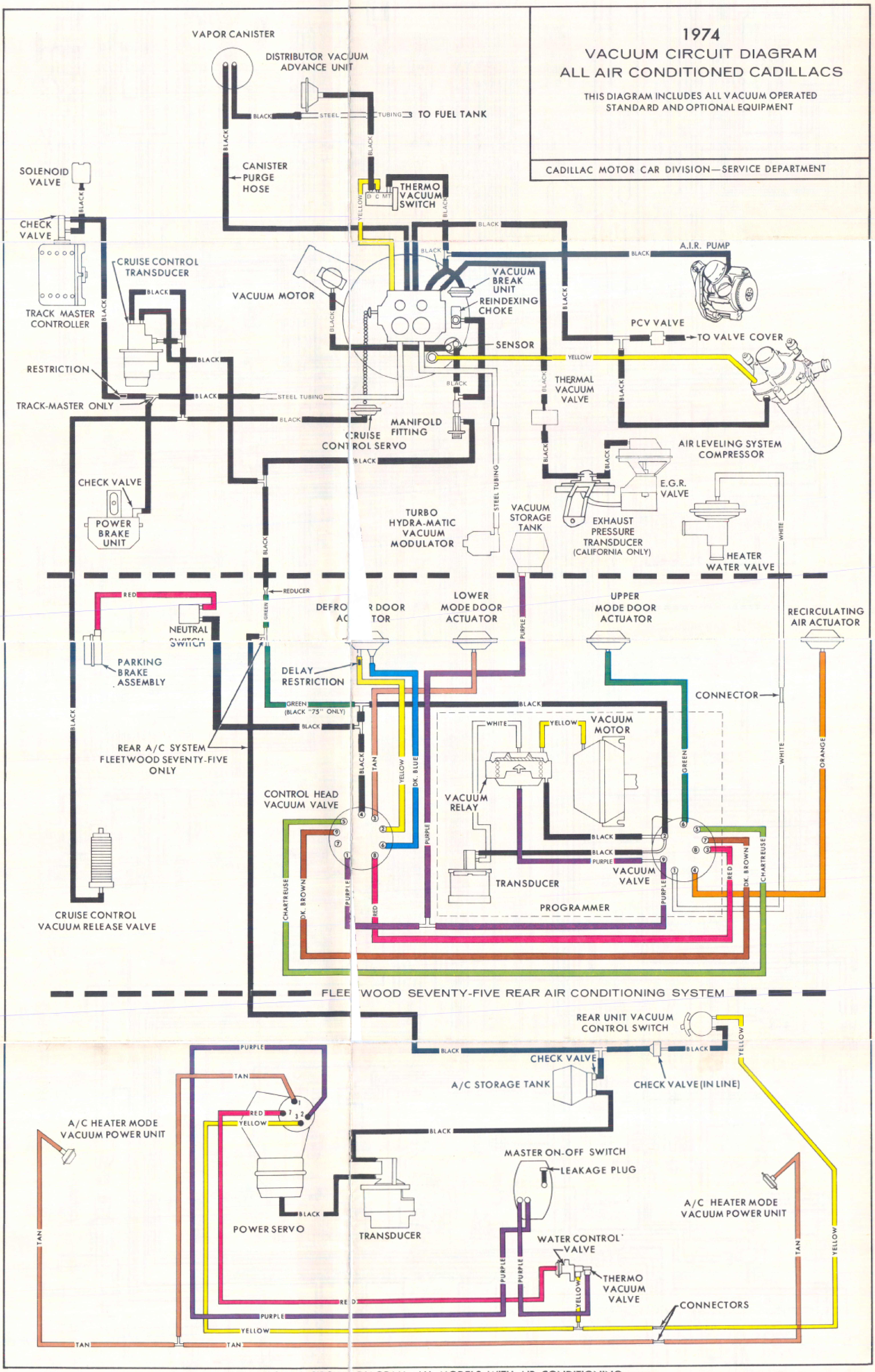
1 normal atmosphere ... = { 1.0332 kg. per sq. cm. / 1.0133 bars / 14.696 lb. per sq. in. / 29.92 inches of mercury }

Torque

Foot Pound .... = 1.36 Newton-meters (N-m)
Inch Pound ..... = 0.11 Newton-meters

Temperature

Degrees Fahrenheit .... = Degrees Celsius (C) x 9/5 +32
Degress Celsius (C) ..... = Degrees Fahrenheit -32 x 5/9



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